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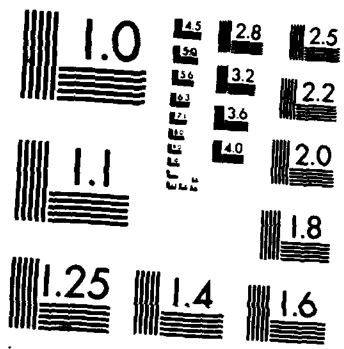

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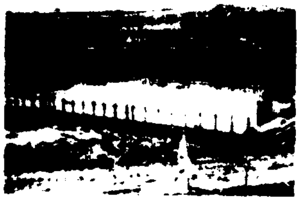

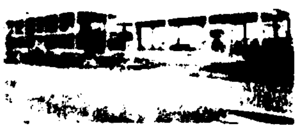

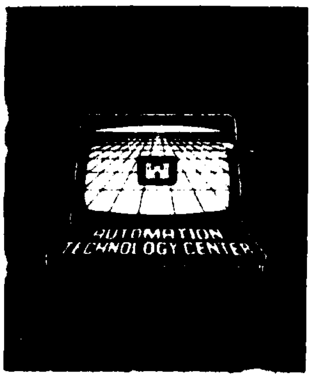

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COMPUTER-AIDED STRUCTURAL ENGINEERING (CASE) PROJECT

TECHNICAL REPORT ATC-86-5

DECISION LOGIC TABLE FORMULATION OF ACI 318-77 BUILDING CODE REQUIREMENTS FOR REINFORCED CONCRETE FOR AUTOMATED CONSTRAINT PROCESSING

Volume II

by

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Final Report

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CONTENTS

Page

APPENDIX A: DECISION LOGIC TABLE FORMULATION OF ACI 318-77, BUILDING CODE REQUIREMENTS FOR REINFORCED CONCRETE, CHAPTERS 12-18

APPENDIX A: DECISION LOGIC TABLE FORMULATION OF ACI 318-77

BUILDING CODE REQUIREMENTS FOR REINFORCED CONCRETE CHAPTERS 12-18

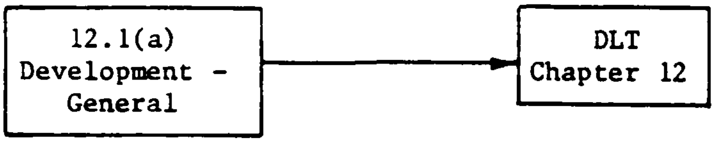
ACI CHAPTER 12: DEVELOPMENT AND SPLICES OF REINFORCEMENT

DLT Chapter 12-1		1	2	3	4	5	6	7	8	9	10	11	
C1	Development of reinforcement - general?	Y	N	N	N	N	N	N	N	N	N	N	E
C2	Deformed bars and deformed wires in tension?	N	Y	N	N	N	N	N	N	N	N	N	L S
C3	Deformed bars in compression?	N	N	Y	N	N	N	N	N	N	N	N	E
C4	Bundled bars?	N	N	N	Y	N	N	N	N	N	N	N	
C5	Standard hooks?	N	N	N	N	Y	N	N	N	N	N	N	
C6	Mechanical anchorage?	N	N	N	N	N	Y	N	N	N	N	N	
C7	Combination development length?	N	N	N	N	N	N	Y	N	N	N	N	
C8	Welded deformed wire fabric in tension?	N	N	N	N	N	N	N	Y	N	N	N	
C9	Welded smooth wire fabric in tension?	N	N	N	N	N	N	N	N	Y	N	N	
C10	Development of pre-stressing strand?	N	N	N	N	N	N	N	N	N	Y	N	
A1	Section 12.1	X											
A2	Section 12.2		X										
A3	Section 12.3			X									
A4	Section 12.4				X								
A5	Section 12.5					X							
A6	Section 12.6						X						
A7	Section 12.7							X					
A8	Section 12.8								X				
A9	Section 12.9									X			
A10	Section 12.10										X		
A11	DLT Chapter 12-2											X	
A12	Logical Error												X

DLT Chapter 12-2		1	2	3	4	5	
C1	Development of flexural reinforcement general?	Y	N	N	N	N	ELSE
C2	Development of positive moment reinforcement?	N	Y	N	N	N	
C3	Development of negative moment reinforcement?	N	N	Y	N	N	
C4	Development of web reinforcement?	N	N	N	Y	N	
A1	Section 12.11	X					
A2	Section 12.12		X				
A3	Section 12.13			X			
A4	Section 12.14				X		
A5	DLT Chapter 12-3					X	
A6	Logical Error						X

DLT Chapter 12-3		1	2	3	4	5	6	7	
C1	Splices of reinforcement - general?	Y	N	N	N	N	N	N	
C2	Splices of deformed bars and deformed wire in tension?	N	Y	N	N	N	N	N	
C3	Splices of deformed bars in compression?	N	N	Y	N	N	N	N	ELSE
C4	Special splice requirements for columns?	N	N	N	Y	N	N	N	
C5	Splices of welded deformed wire fabric in tension?	N	N	N	N	Y	N	N	
C6	Splices of welded smooth wire fabric in tension?	N	N	N	N	N	Y	N	
A1	Section 12.15	X							
A2	Section 12.16		X						
A3	Section 12.17			X					
A4	Section 12.18				X				
A5	Section 12.19					X			
A6	Section 12.20						X		
A7	DLT 318-77 Index							X	
A8	Logical Error								X

Section 12.1 Map



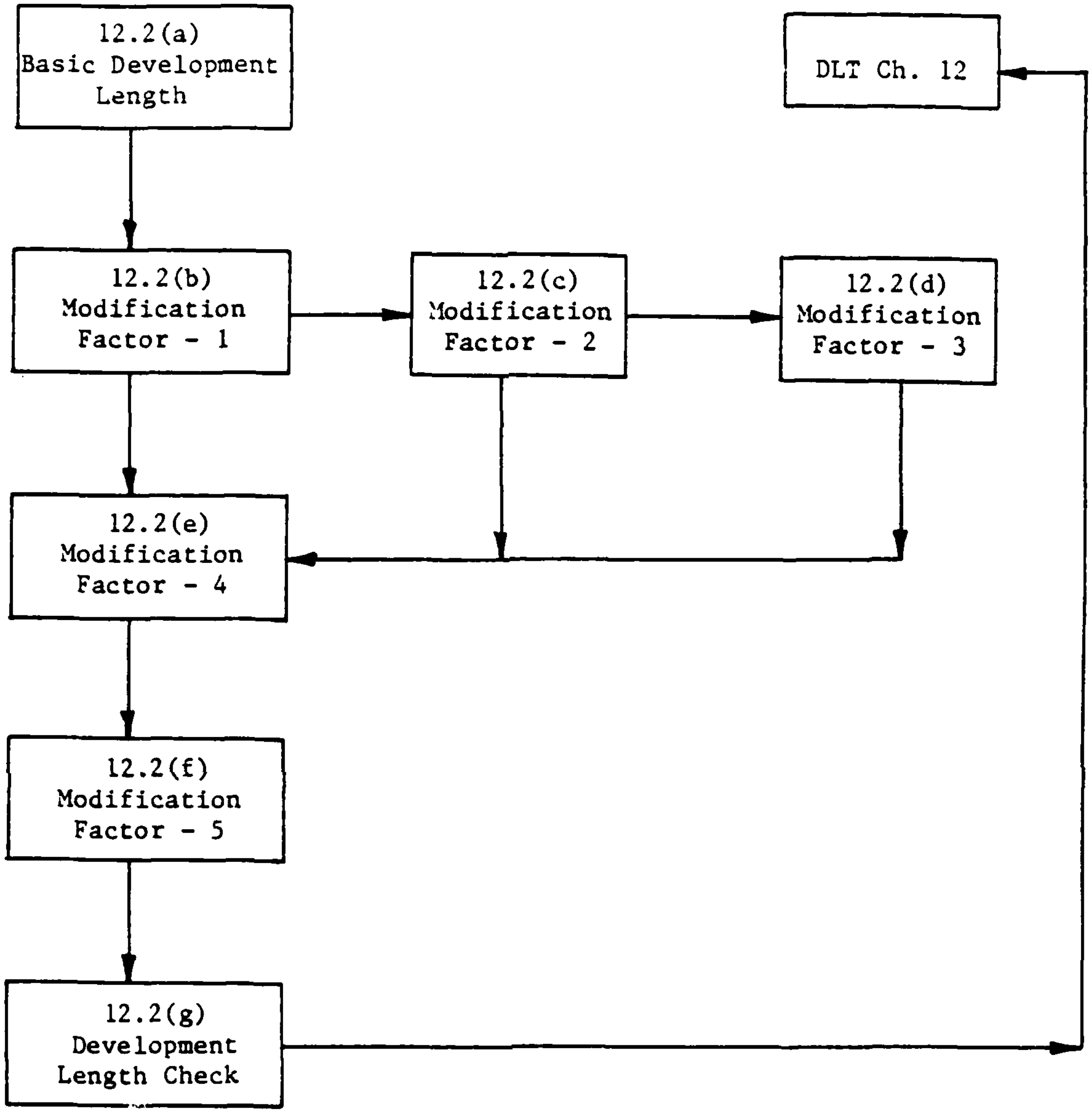
Section 12.1 Development of Reinforcement

Datum 12.1(a)	Source	Label	Number
If calculated tension or compression reinforcement at each section of reinforced concrete members developed on each side of that section by embedment length, end anchorage, or combination thereof.	X		
If hooks used to develop bars in tension.	X		

DLT 12.1(a)	Development - General	1	2
C1	Calculated tension or compression in reinforcement at each section of reinforced concrete members developed on each side of that section by embedment length, end anchorage, or combination thereof?	Y	N
C2	Hooks used to develop bars in tension?	I	I
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT Ch. 12	X	X

Comments: 1) DLT 12.1(a) covers Section 12.1.

Section 12.2 Map



Section 12.2 Development of Deformed Bars and Deformed Wire in Tension

Datum 12.2(a)	Source	Label	Number
Bar size.	X		
Type of reinforcement.	X		
Area of individual bar, sq in.	X	A_b	
Specified yield strength of non-prestressed reinforcement, psi.	X	f_y	
Specified compressive stress of concrete, psi.	X	f'_c	
Nominal diameter of bar, nine or prestressing strand, in.	X	d_b	

	DLT 12.2(a) Basic Development Length	1	2	3	4	
C1	Bar size $\leq$ #11?	Y	N	N	N	E
C2	Bar size = #14?	N	Y	N	N	L
C3	Bar size = #18?	N	N	Y	N	S
C4	Reinforcement = deformed wire?	N	N	N	Y	E
A1	BDL = max. $\left[0.04\ A_b f_y/\sqrt{f'_c},\ 0.0004 d_b f_y\right]$	X				
A2	BDL = $0.085\ f_y/\sqrt{f'_c}$		X			
A3	BDL = $0.11\ f_y/\sqrt{f'_c}$			X		
A4	BDL = $0.03\ d_b f_y/\sqrt{f'_c}$				X	
A5	DLT 12.2(b)	X	X	X	X	
A6	Logical Error					X

Comment:

1) DLT 12.2(a) covers Section 12.2.2 and partially covers Section 12.2.1.

Datum 12.2(b)	Source	Label	Number
If top reinforcement.	X		
If lightweight concrete.	X		
Specified yield strength of non-prestressed reinforcement, psi.	X	f_y	

	DLT 12.2(b) Modification Factor - 1	1	2	3	4	5	6	7	8
C1	Top reinforcement?	Y	Y	Y	Y	N	N	N	N
C2	$f_y > 60000$?	Y	Y	N	N	Y	Y	N	N
C3	Lightweight concrete?	Y	N	Y	N	Y	N	Y	N
A1	$F_1 = (1.4)(2 - 60000/f_y)$	X	X						
A2	$F_2 = 1.4$			X	X				
A3	$F_3 = (2 - 60000/f_y)$					X	X		
A4	DLT 12.2(e)		X		X		X		X
A5	DLT 12.2(c)	X		X		X		X	

Comment: 1) DLT 12.2(b) partially covers Section 12.2.3.

Datum 12.2(c)	Source	Label	Number
If f_{ct} specified.	X		
Average splitting tensile strength of lightweight aggregate concrete, psi.	X	f_{ct}	
Specified compressive strength of concrete, psi.	X	f'_c	
If concrete proportioned by Section 4.2.	X		

DLT 12.2(c)	Modification Factor - 2	1	2	3
C1	f_{ct} specified?	Y	Y	N
C2	Concrete proportioned by Section 4.2?	Y	N	I
A1	$F_4 = \max[6.7\sqrt{f'_c}/f_{ct},\ 1.0]$	X		
A2	Provisions = satisfied	X		
A3*	No Provision		X	
A4	DLT 12.2(d)			X
A5	DLT 12.2(e)	X	X	

Comment:

1) DLT 12.2(c) partially covers Section 12.2.3.

* For lightweight concrete with f_{ct} specified, but not proportioned by Section 4.2, the Code is ambiguous as to modification factor.

Datum 12.2(d)	Source	Label	Number
If "all-lightweight" concrete.	X		
If "sand-lightweight" concrete.	X		
If partial sand replacement.	X		

	DLT 12.2(d) Modification Factor - 3	1	2	3	
C1	"All-lightweight" concrete?	Y	N	N	ELSE
C2	"Sand-lightweight" concrete?	N	Y	N	
C3	Partial sand replacement used?	N	N	Y	
A1	$F_5 = 1.33$	X			
A2	$F_5 = 1.18$		X		
A3	F_5 = linear interpolation between 1.33 - 1.18			X	
A4	DLT 12.2(e)	X	X	X	
A5	Logical Error				X

Comment: 1) DLT 12.2(d) partially covers Section 12.12.3.

Datum 12.2(e)	Source	Label	Number
If reinforcement spaced laterally at least 6" on center with at least 3" clear from face of member to edge bar, measured in direction of spacing.	X		

DLT 12.2(e) Modification Factor - 4		1	2
C1	Reinforcement spaced laterally at least 6" on center with at least 3" clear from face of member to edge bar, measured in direction of spacing?	Y	N
A1	$F_6 = 0.8$	X	
A2	DLT 12.2(f)	X	X

Comments: 1) DLT 12.2(e) covers Section 12.2.4(a).

2) The factors of Section 12.2.4 are optional. Because the factors serve to establish the minimum acceptable development length, they are included herein.

Datum 12.2(f)	Source	Label	Number
If reinforcement in a flexural member in excess of that required by analysis.	X		
If reinforcement enclosed within spiral reinforcement not less than ¼" diameter and not more than 4" pitch.	X		
Area of nonprestressed flexural reinforcement (required) sq in.	X	A_{sr}	
Area of nonprestressed flexural reinforcement (provided) sq in.	X	A_s	
Basic development length, in.	DLT 12.2(a)	BDL	
Modification factors.	DLT 12.2 (b,c,d,e,f)	F_i	

DLT 12.2(f) Modification Factor - 5		1	2	3	
C1	Reinforcement in a flexural member in excess of that required by analysis?	Y	N	N	ELSE
C2	Reinforcement enclosed within spiral reinforcement not less than ¼" diameter and not more than 4" pitch?	N	Y	N	
A1	$F_7 = A_s/A_{sr}$	X			
A2	$F_8 = 0.75$		X		
A3*	$BDLF = \max\left[BDL \prod_{i=1}^{8} F_i, 12 \text{ in.}\right]$	X	X	X	
A4	DLT 12.2(g)	X	X	X	
A5	Logical Error				X

Comments:

1) DLT 12.2(f) covers Section 12.2.4.
2) It is assumed that part (b) of this section and part (c) may not be combined.
3) The provisions of Section 12.2.4 are optional. Because the factors serve to establish minimum acceptable development length, they are included herein.

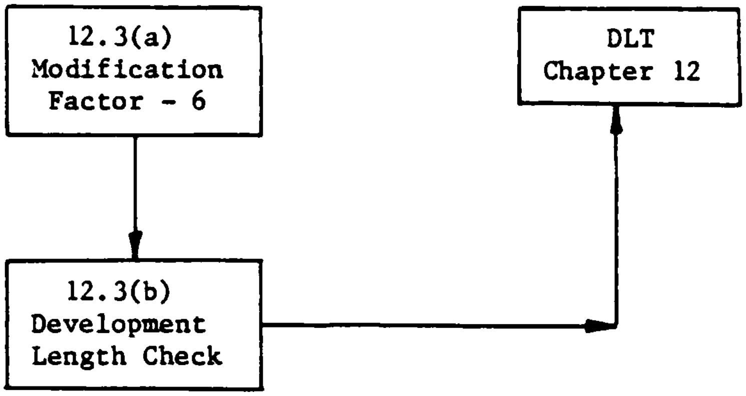
* See footnote to DLT 12.8(b).

Datum 12.2(g)	Source	Label	Number
Product of basic development length and modification factors.	DLT 12.2(f)	BDLF	
Development length, in.	X	ℓ_d	

DLT 12.2(g) Development Length Check		1	2
C1	$\ell_d \geq$ BDLF?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT Ch. 12	X	X

Comments: 1) DLT 12.2(g) covers Sections 12.2.1 and 12.2.5.

Section 12.3 Map



Section 12.3 Development of Deformed Bars in Compression

Datum 12.3(a)	Source	Label	Number
Area of nonprestressed flexural reinforcement (provided) sq in.	X	A_s	
Area of nonprestressed flexural reinforcement required by analysis, sq in.	X	A_{sr}	
Nominal diameter of bar, wire or prestressing strand, in.	X	d_b	
Specified yield strength of nonprestressed reinforcement, psi.	X	f_y	
Square root of specified compressive strength of concrete, psi.	X	$\sqrt{f'_c}$	
If reinforcement enclosed within spiral reinforcement is not less than ¼" in diameter and not more than 4" pitch.	X		

	DLT 12.3(a) Modification Factor - 6	1	2	3	
C1	$A_s > A_{sr}$?	Y	N	N	ELSE
C2	Reinforcement enclosed within spiral reinforcement not less than ¼" in diameter and not more than 4" pitch?	N	Y	N	
A1	$F_7 = A_s/A_{sr}$	X			
A2	$F_8 = 0.75$		X		
A3	$BDLF = \max\{F_7[0.02\ d_b f_y/\sqrt{f'_c},\ 0.0003\ d_b f_y],\ 8\ in.\}$	X			
A4	$BDLF = \max\{F_8[0.02\ d_b f_y/\sqrt{f'_c},\ 0.0003\ d_b f_y],\ 8\ in.\}$		X		
A5	$BDLF = \max[0.02\ d_b f_y/\sqrt{f'_c},\ 0.0003\ d_b f_y,\ 8\ in.]$			X	
A6	DLT 12.3(b)	X	X	X	
A7	Logical Error				X

Comment:

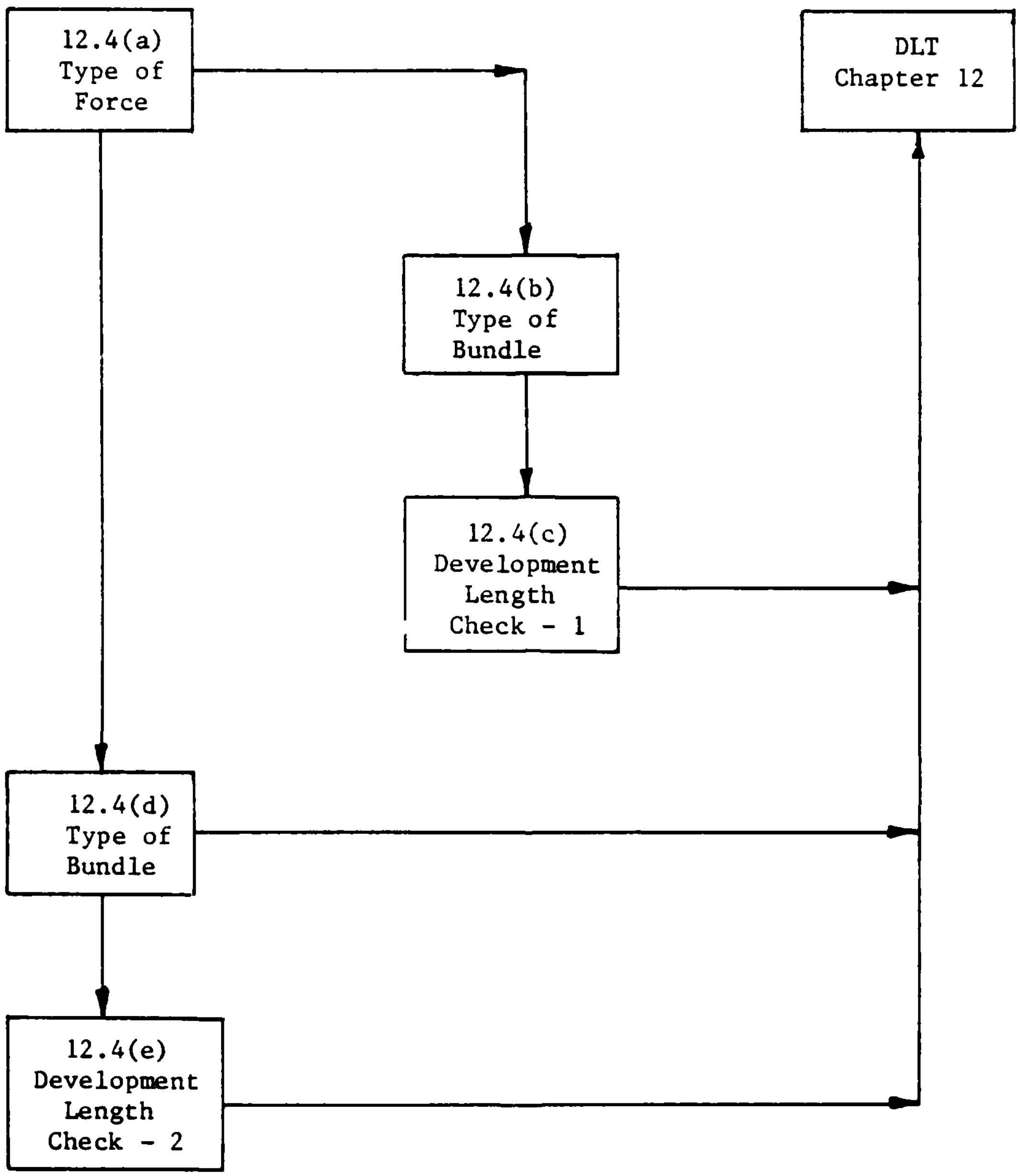
1) DLT 12.3(a) covers Sections 12.3.2 and 12.3.3.

Datum 12.3(b)	Source	Label	Number
Development length, in.	X	ℓ_d	
Product of basic development length and modification factor.	DLT 12.3(a)	BDLF	

DLT 12.3(b) Development Length Check		1	2
C1	$\ell_d \geq$ BDLF?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT Ch. 12	X	X

Comment: 1) DLT 12.3(b) covers Section 12.3.1.

Section 12.4 Map



Section 12.4 Development of Bundled Bars

Datum 12.4(a)	Source	Label	Number
If bundled bars are in tension.	X		

DLT 12.4(a) Type of Force		1	2
C1	Bundled bars in tension?	Y	N
A1	DLT 12.4(b)	X	
A2	DLT 12.4(d)		X

Comment: 1) DLT 12.4(a) partially covers Section 12.4.

Datum 12.4(b)	Source	Label	Number
If number of bars in bundle = 3.	X		
If number of bars in bundle = 4.	X		
Product of basic development length and modification factors.	DLT 12.2(f)	BDLF	

DLT 12.4(b)	Type of Bundle	1	2	3	
C1	Three bar bundle?	Y	N	N	ELSE
C2	Four bar bundle?	N	Y	N	
A1	BDLF = 1.2 BDLF	X			
A2	BDLF = 1.33 BDLF		X		
A3	No provision, DLT Ch. 12			X	
A4	DLT 12.4(c)	X	X	X	
A5	Logical Error				X

Comment: 1) DLT 12.4(b) partially covers Section 12.4.

Datum 12.4(c)	Source	Label	Number
Development length of individual bar in bundle.	X	ℓ_{db}	
Product of basic development length, modification factors and percent increase.	DLT 12.4(b)	BDLF	

DLT 12.4(c) Development Length Check - 1		1	2
C1	$\ell_{db} \geq$ BDLF?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT Ch. 12	X	X

Comment: 1) DLT 12.4(c) partially covers Section 12.4.

Datum 12.4(d)	Source	Label	Number
If number of bars in bundle = 3.	X		
If number of bars in bundle = 4.	X		
Product of basic development length and modification factor.	DLT 12.3(a)	BDLF	

DLT 12.4(d)	Type of Bundle	1	2	3	
C1	Three bar bundle?	Y	N	N	ELSE
C2	Four bar bundle?	N	Y	N	
A1	BDLF = 1.2 BDLF	X			
A2	BDLF = 1.33 BDLF		X		
A3	No Provision, DLT Ch. 12			X	
A4	DLT 12.4(e)	X	X	X	
A5	Logical Error				X

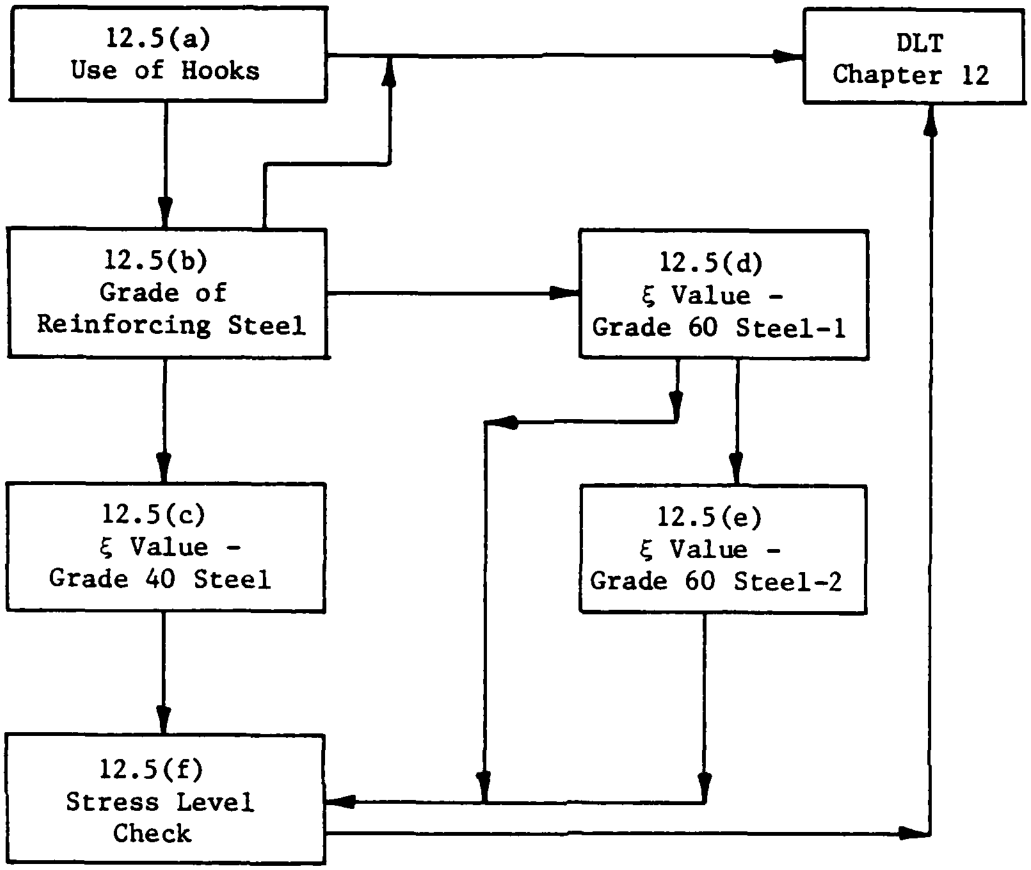
Comment: 1) DLT 12.4(d) partially covers Section 12.4.

Datum 12.4(e)	Source	Label	Number
Development length of individual bar in a bundle.	X	ℓ_{db}	
Product of basic development length, modification factors and percentage increase.	DLT 12.4(d)	BDLF	

DLT 12.4(e) Development Length Check - 2		1	2
C1	$\ell_{db} \geq$ BDLF?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT Ch. 12	X	X

Comment: 1) DLT 12.4(e) partially covers Section 12.4.

Section 12.5 Map



Section 12.5 Standard Hooks in Tension

Datum 12.5(a)	Source	Label	Number
If hooks used to develop reinforcement in tension.	X		

DLT 12.5(a)	Use of Hooks	1	2
C1	Hooks used to develop reinforcement in tension?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT Chapter 12		X
A4	DLT 12.5(b)	X	

Comments:

1) DLT 12.5(a) covers Section 12.5.3.

2) This check seems redundant as the hook must be in tension by definition of the section.

Datum 12.5(b)	Source	Label	Number
Design yield strength of non-prestressed reinforcement, ksi.	X	f_{yd}	

DLT 12.5(b)	Grade of Reinforcement Steel	1	2	3	
C1	f_{yd} = 60?	Y	N	N	ELSE
C2	f_{yd} = 40?	N	Y	N	
A1	DLT 12.5(d)	X			
A2	DLT 12.5(c)		X		
A3	No Provision, DLT Ch. 12			X	
A4	Logical Error				X

Comment: 1) DLT 12.5(b) partially covers Table 12.5.1 ξ values.

Datum 12.5(c)	Source	Label	Number
Bar size.	X		

DLT 12.5(c) ξ value - GR 40 Steel		1	2	3	
C1	Bar size $\leq$ #11?	Y	N	N	ELSE
C2	Bar size = #14?	N	Y	N	
C3	Bar size = #18?	N	N	Y	
A1*	ξ = 360	X			
A2*	ξ = 330		X		
A3*	ξ = 220			X	
A4	DLT 12.5(f)	X	X	X	
A5	Logical Error				X

Comment:

1) DLT 12.5(c) partially covers Table 12.5.1 ξ values.

* ξ may be increased by 30% where enclosure is provided perpendicular to the plane of the hook. Enclosure may consist of external concrete or internal closed ties, spirals, or stirrups. See Section 7.9.

Datum 12.5(d)	Source	Label	Number
If top bar.	X		
Bar size.	X		

DLT 12.5(d) ξ value GR 60-1		1	2	3	4	5	6	
C1	Top bar?	Y	Y	Y	Y	Y	N	E
C2	#3 ≤ bar size ≤ #5?	Y	N	N	N	N		L
C3	Bar size = #6?	N	Y	N	N	N		S
C4	#7 ≤ bar size ≤ #11?	N	N	Y	N	N		E
C5	Bar size = #14?	N	N	N	Y	N		
C6	Bar size = #18?	N	N	N	N	Y		
A1*	ξ = 540	X						
A2*	ξ = 450		X					
A3*	ξ = 360			X				
A4*	ξ = 330				X			
A5*	ξ = 220					X		
A6	DLT 12.5(f)	X	X	X	X	X		
A7	DLT 12.5(e)						X	
A8	Logical Error							X

Comment:

1) DLT 12.5(d) partially covers Table 12.5.1 ξ values.

* Values of ξ may be increased by 30% where enclosure is provided perpendicular to plane of hook. Enclosure may consist of external concrete or internal closed ties, spirals, or stirrups. See Section 7.9.

Datum 12.5(e)	Source	Label	Number
Bar size.	X		

DLT 12.5(e) ξ values GR 60-2		1	2	3	4	5	
C1	#3 ≤ bar size ≤ #9?	Y	N	N	N	N	E
C2	Bar size = #10?	N	Y	N	N	N	L
C3	Bar size = #11?	N	N	Y	N	N	S
C4	Bar size = #14?	N	N	N	Y	N	E
C5	Bar size = #18?	N	N	N	N	Y	
A1*	$\xi = 540$	X					
A2*	$\xi = 480$		X				
A3*	$\xi = 420$			X			
A4*	$\xi = 330$				X		
A5*	$\xi = 220$					X	
A6	DLT 12.5(f)	X	X	X	X	X	
A7	Logical Error						X

Comment:

1) DLT 12.5(e) partially covers Table 12.5.1 ξ values.

* Values of ξ may be increased by 30% where enclosure is provided perpendicular to the plane of hook. Enclosure may consist of external concrete or internal closed ties, spirals, or stirrups. See Section 7.9.

Datum 12.5(f)	Source	Label	Number
Square root of specified compressive strength of concrete, psi.	X	$\sqrt{f'_c}$	
Constant for standard hook.	DLT 12.5 (c,d,e)	ξ	
Maximum tensile stress developed by standard hook used in design.	X	TM	

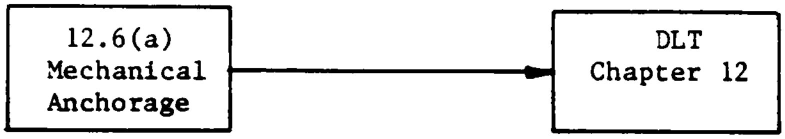
DLT 12.5(f) Stress Level Check		1	2
C1	TM $\leq \xi\sqrt{f'_c}$?	Y	N
A1	Provision = satisfied	X	
A2	Provision $\neq$ satisfied		X
A3	DLT Chapter 12	X	X

Comments:

1) DLT 12.5(f) covers Section 12.5.1.

2) The Code implies that the standard hook used in design should be at a stress less than ($\xi\sqrt{f'_c}$), although no specific requirement is stated.

Section 12.6 Map



Section 12.6 Mechanical Anchorage

Datum 12.6(a)	Source	Label	Number
If test results showing adequacy of mechanical device* presented to Building Official.	X		

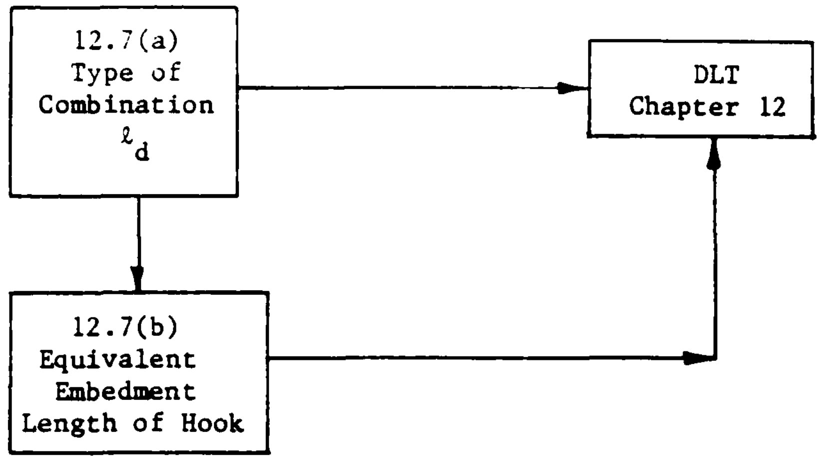
DLT 12.6(a) Mechanical Anchorage		1	2
C1	Test results showing adequacy of mechanical device presented to Building Official?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT Chapter 12	X	X

Comment:

1) DLT 12.6(a) covers Section 12.6.2.

* According to Section 12.6.1 any mechanical device capable of developing the strength of reinforcement without damage to concrete may be used.

Section 12.7 Map



Section 12.7 Combination Development Length

Datum 12.7(a)	Source	Label	Number
If reinforcement in tension.	X		
If development length, ℓ_d, consists of equivalent embedment length of a hook plus additional embedment length of reinforcement.	X		
If development length, ℓ_d, consists of equivalent embedment length of mechanical anchorage plus additional embedment length of reinforcement.	X		

DLT 12.7(a)	Type of Combination ℓ_d	1	2	3	4	5	
C1	Reinforcement in tension?	Y	Y	N	N	N	E
C2	Development length, ℓ_d, consists of equivalent embedment length of a hook plus additional embedment length of reinforcement?	Y	N	Y	N	N	L S
C3	Development length, ℓ_d, consists of equivalent embedment length of mechanical anchorage plus additional embedment length of reinforcement?	N	I	N	Y	N	E
A1	Provision = satisfied	X	X			X	
A2	Provision ≠ satisfied			X	X		
A3	DLT Chapter 12		X	X	X	X	
A4	DLT 12.7(b)	X					
A5	Logical Error						X

Comments:

1) DLT 12.7(a) covers Section 12.7.

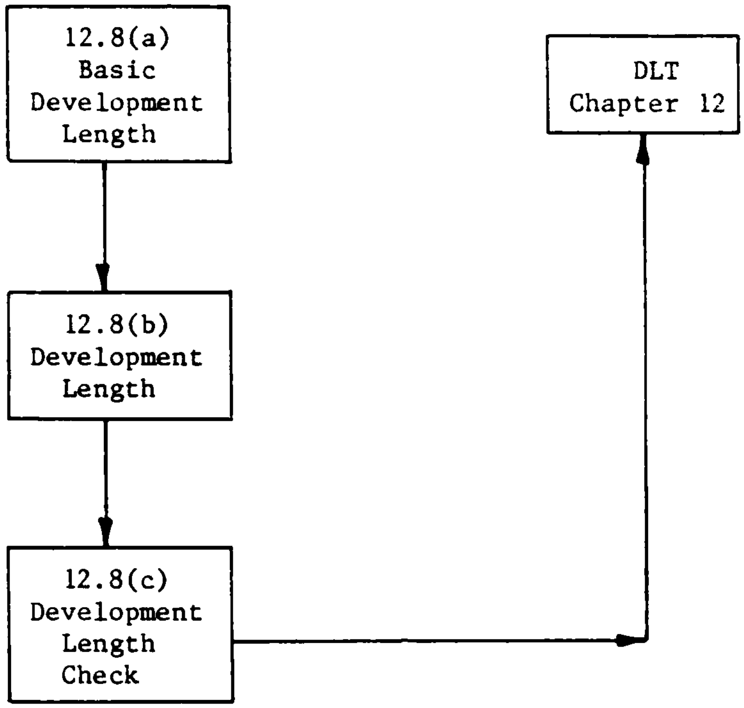
2) Section 12.7 was interpreted to mean that an equivalent embedment length of mechanical anchorage may be calculated.

Datum 12.7(b)	Source	Label	Number
If equivalent embedment length, ℓ_e, of standard hook computed using provisions of Section 12.2.2 by substituting f_h for f_y and ℓ_e for ℓ_d.	X		

DLT 12.7(b)	Equivalent Embedment Length of Hook	1	2
C1	Equivalent embedment length, ℓ_e, of a standard hook computed using provisions of Section 12.2.2 by substituting f_h for f_y and ℓ_e for ℓ_d?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT Ch. 12	X	X

Comment: 1) DLT 12.7(b) covers Section 12.5.2.

Section 12.8 Map



Section 12.8 Development of Welded Wire Deformed Fabric in Tension

Datum 12.8(a)	Source	Label	Number
Distance of cross wire from point of critical section.	X	CWD	
Nominal diameter of bar, wire or prestressing strand, in.	X	d_b	
Specified yield strength of nonprestressed reinforcement, psi.	X	f_y	
Square root of specified compressive strength of concrete, psi.	X	$\sqrt{f'_c}$	
Area of individual wire to be developed or spliced, sq in.	X	A_w	
Spacing of wire to be developed or spliced, sq in.	X	S_w	

DLT 12.8(a)	Basic Development Length	1	2
C1	CWD $\geq$ 2 in. from point of critical section and $< \max\left[0.03\ d_b(f_y - 20000)/\sqrt{f'_c},\ 0.02\ \frac{A_w}{S_w}\frac{f_y}{\sqrt{f'_c}},\ 8\text{ in.}\right]$?	Y	N
A1	$BDL = \max\left[0.03\ d_b(f_y - 20000)/\sqrt{f'_c},\ 0.02\ \frac{A_w}{S_w}\frac{f_y}{\sqrt{f'_c}}\right]$	X	
A2	$BDL = 0.03\ d_b\ \frac{f_y}{\sqrt{f'_c}}$		X
A3	DLT 12.8(b)	X	X

Comment: 1) DLT 12.8(a) covers Sections 12.8.2 and 12.8.3.

Datum 12.8(b)	Source	Label	Number
Modification factor(s).	DLT 12.2 (b,c,d,e,f)	F_i	
Basic development length.	DLT 12.8(a)	BDL	
If development length used for development of web reinforcement per Section 12.14?	X		

DLT 12.8(b) Development Length		1	2
C1	Development length used for development of web reinforcement per Section 12.14?	Y	N
A1*	$BDLF = \max\left[BDL \prod_{i=1}^{8} F_i,\ 8\text{ in.}\right]$		X
A2*	$BDLF = \max\left[BDL \prod_{i=1}^{8} F_i,\ 12\text{ in.}\right]$	X	
A3	DLT 12.8(c)	X	X

Comments:

1) DLT 12.8(b) partially covers Section 12.8.1.

2) The different minimum development length from Section 12.14 is incorporated in A2.

3) Requirements of Section 12.19 seem to be compatible with those of this Section, therefore no modifications are necessary.

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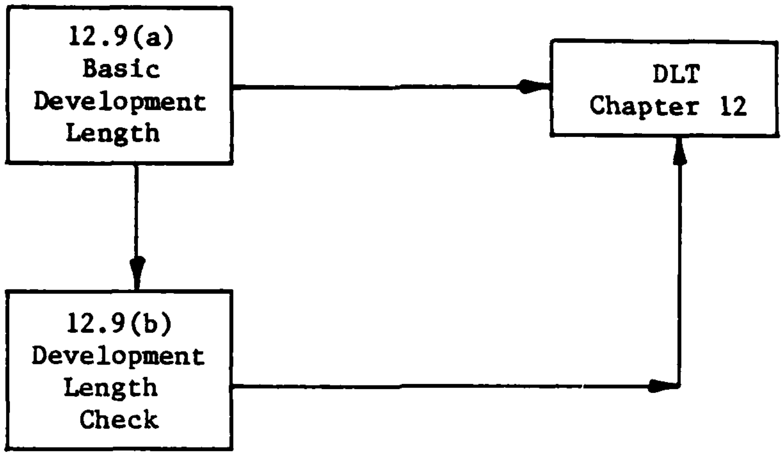
* $\prod_{i=1}^{8}$ denotes the product of only the factors F which are applicable for a given case. All eight factors will not be applicable simultaneously.

Datum 12.8(c)	Source	Label	Number
Development length provided, in.	X	ℓ_d	
Development length required, in.	DLT 12.8(b)	BDLF	

DLT 12.8(c) Development Length Check		1	2
C1	$\ell_d \geq$ BDLF?	Y	N
A1	Provision = satisfied	X	
A2	Provision $\neq$ satisfied		X
A3	DLT Ch. 12	X	X

Comment: 1) DLT 12.8(c) partially covers Section 12.8.1.

Section 12.9 Map



Section 12.9 Development of Welded Smooth Wire Fabric in Tension

Datum 12.9(a)	Source	Label	Number
If two cross wires are within the development length provided (measured from critical section to outermost cross wire).	X		
If closer of the two wires is at a distance $\geq$ 2 in. from critical section.	X		
Area of individual wire to be developed or spliced, sq in.	X	A_w	
Spacing of individual wire to be developed or spliced, in.	X	S_w	
Specified yield strength of nonprestressed reinforcement, psi.	X	f_y	
Square root of specified compressive strength of concrete, psi.	X	$\sqrt{f'_c}$	
Modification factor(s).	DLT 12.2 (c,d,f)	F_i (i=4,5,7)	

DLT 12.9(a)	Basic Development Length	1	2	3	
C1	Two cross wires within ℓ_d?	Y	Y	N	ELSE
C2	Closer of the two cross wires $\geq$ 2 in. from critical section?	Y	N		
A1	Provision = satisfied	X			
A2	Provision $\neq$ satisfied		X	X	
A3	BDLF = $\max\left[0.27 \frac{A_w}{S_w} \frac{f_y}{\sqrt{f'_c}} \cdot F_7 \cdot F_4 \cdot F_5,\ 6 \text{ in.}\right]$	X	X	X	
A4	DLT 12.9(b)	X	X	X	
A5	DLT Chapter 12				X

Comments:

1) DLT 12.9(a) partially covers Section 12.9.

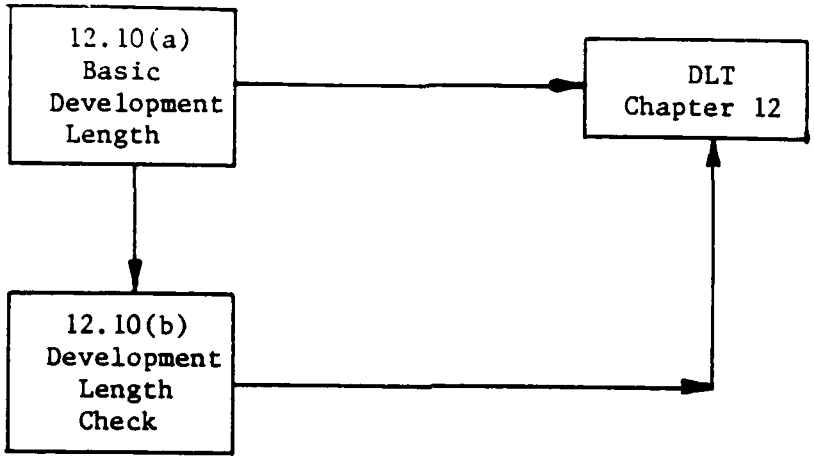
2) Requirements of Section 12.20 seem to be compatible with those of this Section, therefore no modifications are necessary.

Datum 12.9(b)	Source	Label	Number
Development length provided, in.	X	ℓ_d	
Development length required, in.	DLT 12.9(a)	BDLF	

DLT 12.9(b) Development Length Check		1	2
C1	$\ell_d \geq$ BDLF?	Y	N
A1	Provision = satisfied	X	
A2	Provision $\neq$ satisfied		X
A3	DLT Ch. 12	X	X

Comment: 1) DLT 12.9(b) partially covers Section 12.9.

Section 12.10 Map



Section 12.10 Development of Prestressing Strand

Datum 12.10(a)	Source	Label	Number
If three- or seven-wire prestressing strand.	X		
If bonding of a strand does not extend to end of member.	X		
Stress in prestressed reinforcement at nominal strength, ksi.	X	f_{ps}	
Effective stress in prestressed reinforcement (after allowance for all prestress losses), ksi.	X	f_{se}	
Nominal diameter of bar, wire or prestressing strand, in.	X	d_b	

DLT 12.10(a)	Basic Development Length	1	2	3
C1	Three- or seven-wire prestressing strand?	Y	Y	N
C2	Bonding of strand does not extend to end of a member?	Y	N	I
A1*	$BDLF = \left(f_{ps} - \frac{2}{3} f_{se}\right) d_b \cdot 2$	X		
A2*	$BDLF = \left(f_{ps} - \frac{2}{3} f_{se}\right) d_b$		X	
A3	No Provision, DLT Chapter 12			X
A4	DLT 12.10(b)	X	X	

Comment:

1) DLT 12.10(a) partially covers Section 12.10.1 and all of Section 12.10.3.

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* Expression in parenthesis used as a constant without units.

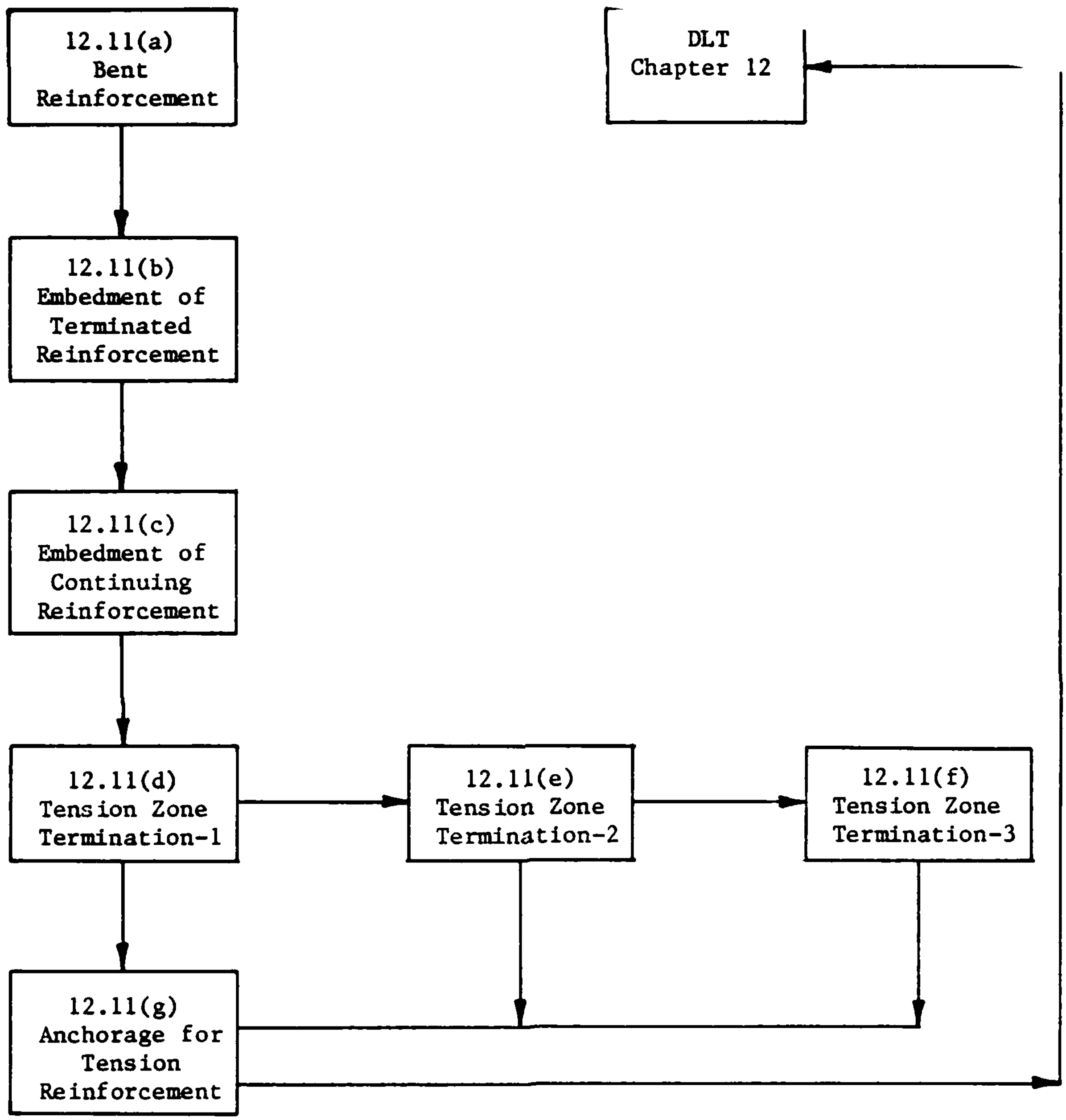
Datum 12.10(b)	Source	Label	Number
Development length provided, in.	X	ℓ_d	
Development length required, in.	DLT 12.10(a)	BDLF	

DLT 12.10(b) Development Length Check		1	2
C1	$\ell_d \geq$ BDLF?	Y	N
A1	Provision = satisfied	X	
A2	Provision $\neq$ satisfied		X
A3	DLT Ch. 12	X	X

Comments: 1) DLT 12.10(b) covers Section 12.10.1.

2) According to 12.10.2 investigation may be limited to cross sections nearest each end of the member that is required to develop full design strength under specified factored loads.

Section 12.11 Map



Section 12.11 Development of Flexural Reinforcement - General

Datum 12.11(a)	Source	Label	Number
If tension reinforcement is developed by bending across web to be anchored or made continuous with reinforcement on the opposite face of the member.	X		

DLT 12.11(a) Bent Reinforcement		1
C1	Tension reinforcement developed by bending across web to be anchored or made continuous with reinforcement on the opposite face of the member?	I
A1	Provision = satisfied	X
A2	DLT 12.11(b)	X

Comment: 1) DLT 12.11(a) covers Section 12.11.1.

Datum 12.11(b)	Source	Label	Number
If section at support of simple span or free end of cantilever.	X		
If reinforcement extends beyond the point at which it is no longer required to resist flexure.	X		
Distance beyond point where reinforcement is no longer needed to resist flexure, in.	X	EXT	
Nominal diameter of bar, wire or prestressing strand, in.	X	d_b	
Distance from extreme compression fiber to centroid of tension reinforcement.	X	d	

DLT 12.11(b)	Embedment of Terminated Reinforcement	1	2	3	4
C1	Section at support of simple span or free end of cantilever?	Y	N	N	N
C2*	Reinforcement extends beyond the point at which it is no longer required to resist flexure?	I	Y	Y	N
C3	EXT $\geq$ max$[d, 12\ d_b]$?	I	Y	N	I
A1	Provision = satisfied	X	X		
A2	Provision $\neq$ satisfied			X	X
A3	DLT 12.11(c)	X	X	X	X

Comment:

1) DLT 12.11(b) covers Sections 12.11.2 and 12.11.3.

* Critical sections for development of reinforcement in flexural members are at points of maximum stress and at points within the span where adjacent reinforcement terminates or is bent.

Datum 12.11(c)	Source	Label	Number
If embedment length of continuing reinforcement is greater than or equal to BDLF beyond the point where it is no longer required to resist flexure.	X		

DLT 12.11(c)	Embedment of Continuing Reinforcement	1	2
C1	Embedment length of continuing reinforcement $\geq$ BDLF beyond the point where it is no longer required to resist flexure?	Y	N
A1	Provision = satisfied	X	
A2	Provision $\neq$ satisfied		X
A3	DLT 12.11(d)	X	X

Comment: 1) DLT 12.11(c) covers Section 12.11.4.

Datum 12.11(d)	Source	Label	Number
If flexural reinforcement terminated in a tension zone.	X		
Factored shear force at cutoff point.	X	V_u	
Nominal shear strength provided by concrete.	Ch. 11	V_c	
Nominal shear strength provided by shear reinforcement.	Ch. 11	V_s	
Strength reduction factor.	X	ϕ	

DLT 12.11(d)	Tension Zone Termination - 1	1	2	3
C1	Flexural reinforcement terminated in a tension zone?	Y	Y	N
C2	$V_u \leq \phi \frac{2}{3} (V_c+V_s)$?	Y	N	I
A1	Provision = satisfied	X		X
A2	DLT 12.11(g)	X		X
A3	DLT 12.11(e)		X	

Comment:

1) DLT 12.11(d) partially covers 12.11.5 and all of 12.11.5.1.

Datum 12.11(e)	Source	Label	Number
Stirrup area provided to resist shear and torsion, sq in.	X	A_v	
Stirrup area required to resist shear and torsion, sq in.	X	A_{vr}	
Web width or diameter of circular section.	X	b_w	
Spacing of stirrups or ties, in.	X	s	
Specified yield strength of non-prestressed reinforcement, psi.	X	f_y	
Distance stirrups provided along each terminated bar or wire from the termination point.	X	DXT	
Distance from extreme compression fiber to centroid of tension reinforcement, in.	X	d	
Ratio of area of reinforcement cut off to total area of tension reinforcement at the section.	X	β_b	

DLT 12.11(e)	Tension Zone Termination - 2	1	2	3	4
C1	$60\ b_w s/f_y \leq A_v > A_{vr}$?	Y	Y	Y	N
C2	DXT $\geq$ 3/4 d?	Y	Y	N	I
C3	s $\leq d/8\beta_b$?	Y	N	I	I
A1	Provision = satisfied	X			
A2	DLT 12.11(g)	X			
A3	DLT 12.11(f)		X	X	X

Comment: 1) DLT 12.11(e) covers Section 12.11.5.2 and partially covers 12.11.5.

Datum 12.11(f)	Source	Label	Number
Bar size.	X		
If continuing reinforcement provides double the area required for flexure at the cutoff point.	X		
Factored shear force at section.	X	V_u	
Nominal shear strength of concrete.	Ch. 11	V_c	
Nominal shear strength of shear reinforcement.	Ch. 11	V_s	
Strength reduction factor.	X	ϕ	

DLT 12.11(f)	Tension Zone Termination - 3	1	2	3	4
C1	Bar size $\leq$ #11?	Y	Y	Y	N
C2	Continuing reinforcement provides double the area required for flexure at the cutoff point?	Y	Y	N	I
C3	$V_u \leq \phi \frac{3}{4} (V_c+V_s)$?	Y	N	I	I
A1	Provisions = satisfied	X			
A2	Provisions $\neq$ satisfied		X	X	X
A3	DLT 12.11(g)	X	X	X	X

Comments:

1) DLT 12.11(f) covers Section 12.11.5.3 and partially covers 12.11.5.

2) It is assumed that shear strength permitted includes shear strength of shear reinforcement provided.

Datum 12.11(g)	Source	Label	Number
If reinforcement stress is not directly proportional to moment.*	X		
If adequate end anchorage is provided for tension reinforcement in flexural members.	X		

DLT 12.11(g)	Anchorage for Tension Reinforcement	1	2	3
C1	Reinforcement stress not directly proportional to moment?	Y	Y	N
C2	Adequate end anchorage is provided for tension reinforcement in flexural members?	Y	N	I
A1	Provision = satisfied	X		X
A2	Provision ≠ satisfied		X	
A3	DLT Ch. 12	X	X	X

Comment:

1) DLT 12.11(g) covers Section 12.11.6.

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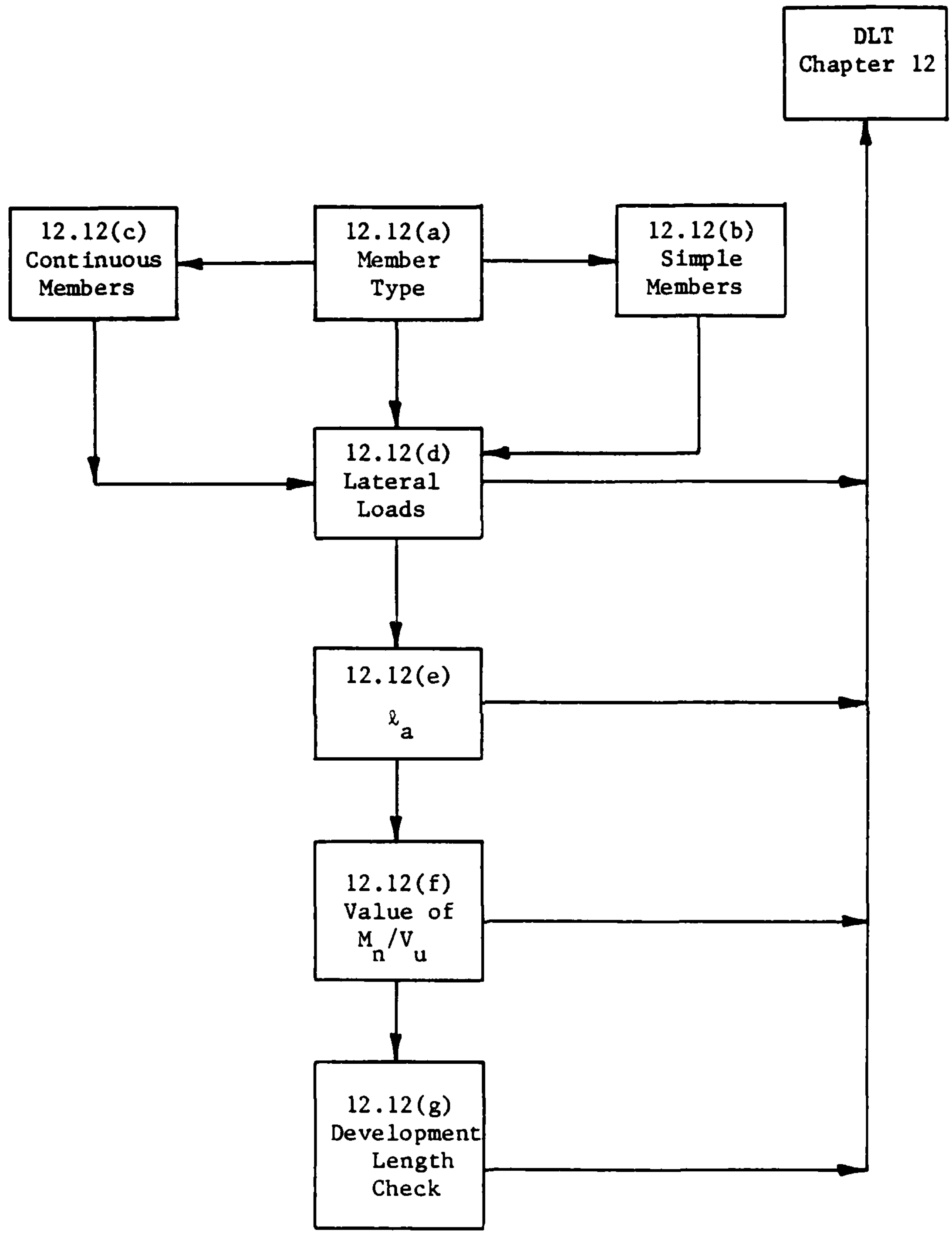
* Such members include: sloped, stepped, or tapered footings; brackets; deep flexural members; or members in which tension reinforcement is not parallel to compression face.

Section 12.12 Map



Section 12.12 Development of Positive Moment Reinforcement

Datum 12.12(a)	Source	Label	Number
If member is simple.	X		
If member is continuous.	X		

DLT 12.12(a) Member Type		1	2	3	
C1	Member simple?	Y	N	N	ELSE
C2	Member continuous?	N	Y	N	
A1	DLT 12.12(b)	X			
A2	DLT 12.12(c)		X		
A3	No Provision, DLT 12.12(d)			X	
A4	Logical Error				X

Comment:

1) DLT 12.12(a) is a switching DLT that partially covers Section 12.12.1.

Datum 12.12(b)	Source	Label	Number
If at least one-third the positive moment reinforcement extends along same face of member into support.	X		
If member is a beam.	X		
If reinforcement extends at least 6 in. into support.	X		

DLT 12.12(b) Simple Members		1	2	3	4
C1	At least one-third of positive moment reinforcement extends along the same face of member into support?	Y	Y	Y	N
C2	Member = beam?	Y	Y	N	I
C3	Positive moment reinforcement extends at least 6" into support?	Y	N	I	I
A1	Provision = satisfied	X		X	
A2	Provision ≠ satisfied		X		X
A3	DLT 12.12(d)	X	X	X	X

Comment: 1) DLT 12.12(b) partially covers Section 12.12.1.

Datum 12.12(c)	Source	Label	Number
If at least one-quarter of positive moment reinforcement extends along same face of member into support.	X		
If member is a beam.	X		
If positive moment reinforcement extends at least 6" into support.	X		

DLT 12.12(c) Continuous Members		1	2	3	4
C1	At least one-quarter of positive moment reinforcement extends along same face of member into support?	Y	Y	Y	N
C2	Member = beam?	Y	Y	N	I
C3	Positive moment reinforcement extends at least 6" into support?	Y	N	I	I
A1	Provision = satisfied	X		X	
A2	Provision ≠ satisfied		X		X
A3	DLT 12.12(d)	X	X	X	X

Comment: 1) DLT 12.12(c) partially covers Section 12.12.1.

Datum 12.12(d)	Source	Label	Number
If flexural member is part of a primary lateral load resisting system.	X		
If reinforcement is anchored to develop specified yield strength, f_y, in tension at the face of the support.	X		

DLT 12.12(d) Lateral Loads		1	2	3
C1	Flexural member is part of a primary lateral load resisting system?	Y	Y	N
C2	Positive moment reinforcement anchored to develop specified yield strength, f_y, in tension at the face of the support?	Y	N	I
A1	Provision = satisfied	X		X
A2	Provision ≠ satisfied		X	
A3	DLT 12.12(e)	X		X
A4	DLT Ch. 12		X	

Comment: 1) DLT 12.12(d) covers Section 12.12.2.

Datum 12.12(e)	Source	Label	Number
If section at simple support.	X		
If section at point of inflection.	X		
Embedment length beyond center of support.	X		
Equivalent embedment length of any hook or mechanical anchorage provided.	X		
Distance from extreme compression fiber to centroid of tension reinforcement, in.	X	d	
Nominal diameter of bar, wire or pre-stressing strand, in.	X	d_b	

DLT 12.12(e) ℓ_a		1	2	3	
C1	Section at simple support?	Y	N	N	ELSE
C2	Section at point of inflection?	N	Y	N	
A1	ℓ_a = sum of embedment length beyond center of support plus equivalent embedment length of any hook or mechanical anchorage provided.	X			
A2	$\ell_a = \max[d, 12\ d_b]$		X		
A3	DLT 12.12(f)	X	X		
A4	DLT Ch. 12			X	
A5	Logical Error				X

Comment: 1) DLT 12.12(e) partially covers Section 12.12.3

Datum 12.12(f)	Source	Label	Number
Nominal moment-strength at section, in-lb.	X	M_n	
Factored shear force at section.	X	V_u	
If ends of reinforcement confined by a compressive reaction.	X		

DLT 12.12(f)	Value of M_n/V_u	1	2
C1	Ends of reinforcement confined by a compressive reaction?	Y	N
A1	$M_n/V_u = M_n/V_u$		X
A2	$M_n/V_u = 1.33\ M_n/V_u$	X	
A3	DLT 12.12(g)	X	X

Comment: 1) DLT 12.12(f) partially covers Section 12.12.3.

Datum 12.12(g)	Source	Label	Number
Ratio of nominal moment strength to factored shear force of section.	DLT 12.12(f)	M_n/V_u	
Additional embedment length of support or point of inflection, in.	DLT 12.12(e)	ℓ_a	
Development length required, in.	DLT 12.2(f)	BDLF	

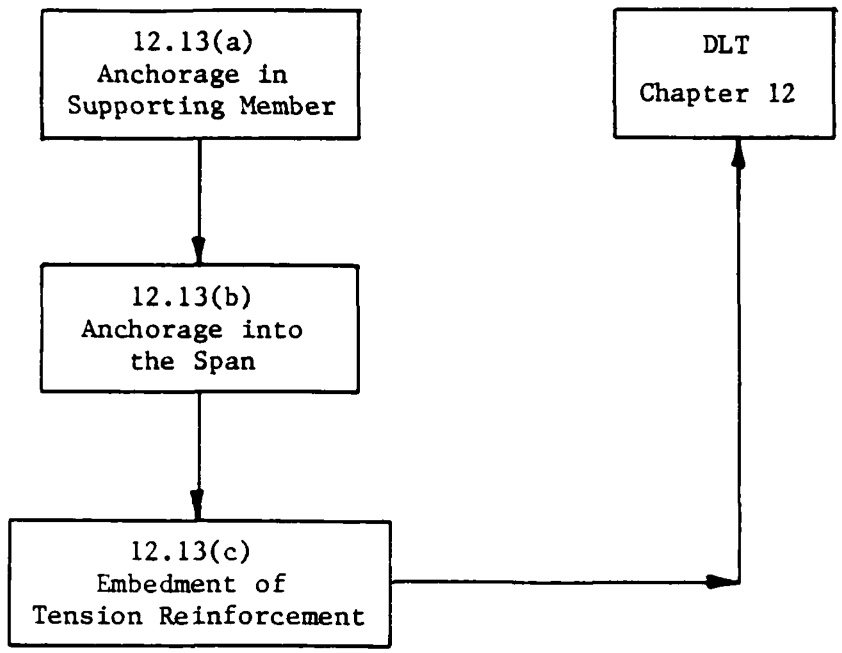
DLT 12.12(g)	Development Length Check	1	2
C1	BDLF $\leq M_n/V_u + \ell_a$?	Y	N
A1	Provision = satisfied	X	
A2	Provision $\neq$ satisfied		X
A3	DLT Ch. 12	X	X

Comments: 1) DLT 12.12(g) partially covers Section 12.12.3.

2) The required ℓ_d is used here because the intent of Section 12.12.3 is to limit bar size. The ℓ_d used in design could satisfy the inequality in C1 but not the intent of the Code requirement.

3) It's assumed that ℓ_d is computed for f_y by definition of development length.

Section 12.13 Map



Section 12.13 Development of Negative Moment Reinforcement

Datum 12.13(a)	Source	Label	Number
If continuous, restrained or cantilevered member or any member of a rigid frame.	X		
If anchored in or through supporting member by embedment length, hooks, or mechanical anchorage.	X		

DLT 12.13(a)	Anchorage in Supporting Member	1	2	3
C1	Continuous, restrained or cantilevered member or member of a rigid frame?	Y	Y	N
C2	Anchored in or through supporting member by embedment length, hooks, or mechanical anchorage?	Y	N	I
A1	Provision = satisfied	X		
A2	Provision ≠ satisfied		X	
A3	DLT 12.13(b)	X	X	X

Comment: 1) DLT 12.13(a) covers Section 12.13.1.

Datum 12.13(b)	Source	Label	Number
If embedment length into span satisfies provisions of Section 12.1.	X		
If embedment length into span satisfies provisions of DLT 12.11(b).	X		

DLT 12.13(b) Anchorage into Span		1	2	3
C1	Embedment length into span satisfies provisions of Section 12.1?	Y	Y	N
C2	Embedment length into span satisfies provisions of DLT 12.11(b)?	Y	N	I
A1	Provision = satisfied	X		
A2	Provision ≠ satisfied		X	X
A3	DLT 12.13(c)	X	X	X

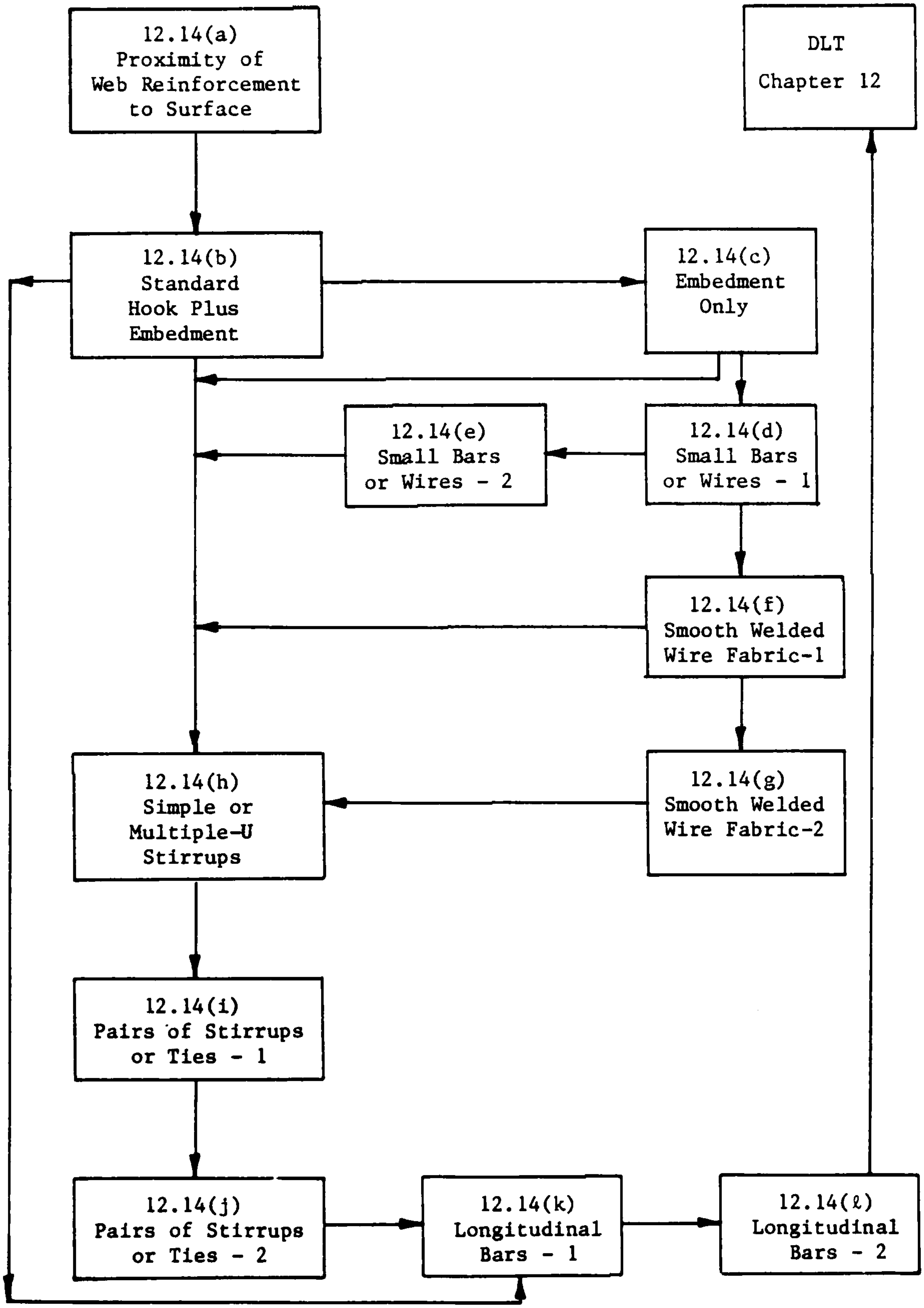
Comment: 1) DLT 12.13(b) covers Section 12.13.2.

DLT 12.13(c)	Source	Label	Number
If at least 1/3 of the total tension reinforcement provided for negative moment at support extends beyond inflection point, in.	X		
Distance beyond inflection point.	X	DIP	
Distance from extreme compression fiber to centroid of tension reinforcement, in.	X	d	
Nominal diameter of bar, wire or prestressing strand, in.	X	d_b	
Clear span measured face-to-face of supports.	X	ℓ_n	

DLT 12.13(c)	Embedment of Tension Reinforcement	1	2	3
C1	At least 1/3 of total tension reinforcement provided for negative moment at support extends beyond point of inflection?	Y	Y	N
C2	DIP $\geq$ max$[12\ d_b,\ d,\ \ell_n/16]$?	Y	N	I
A1	Provision = satisfied	X		
A2	Provision $\neq$ satisfied		X	X
A3	DLT Ch. 12	X	X	X

Comment: 1) DLT 12.13(c) covers Section 12.13.3.

Section 12.14 Map



Section 12.14 Development of Web Reinforcement

Datum 12.14(a)	Source	Label	Number
If web reinforcement carried as close to compression and tension surfaces of member as cover requirements and proximity of other reinforcement will permit.	X		

DLT 12.14(a)	Proximity of Web Reinforcement to Surface	1	2
C1	Web reinforcement carried as close to compression and tension surfaces of member as cover requirements and proximity of other reinforcement will permit?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT 12.14(b)	X	X

Comment: 1) DLT 12.14(a) covers Section 12.14.1.

Datum 12.14(b)	Source	Label	Number
Type of web reinforcement	X		
If anchorage is a standard hook plus embedment.	X		
Development length required, in.	DLT 12.2-12.9	BDLF	
Distance from mid-depth of member to start of hook (point of tangency).	X	DTH	

DLT 12.14(b)	Standard Hook plus Embedment	1	2	3	4
C1	Web reinforcement = single leg or simple-U or multiple-U ?	Y	Y	Y	N
C2	Anchorage is sum of standard hook plus embedment?	Y	Y	N	I
C3	DTH $\geq$ 0.5 BDLF?	Y	N	I	I
A1	Provision = satisfied	X			
A2	Provision $\neq$ satisfied		X		
A3	DLT 12.14(c)			X	
A4	DLT 12.14(h)	X	X		
A5	DLT 12.14(k)				X

Comment: 1) DLT 12.14(b) covers Section 12.14.2.1.

Datum 12.14(c)	Source	Label	Number
Distance from extreme compression fiber to centroid of tension reinforcement.	X	d	
Development length required, in.	DLT 12.2-12.9	BDLF	
Nominal diameter of bar, wire, or prestressing strand.	X	d_b	
If anchorage provided by embedment of straight bar in compression side of member.	X		
If deformed bars or deformed wire.	X		

DLT 12.14(c) Embedment Only		1	2	3	4	5	6
C1	Anchorage provided by embedment of straight bars in compression side of member?	Y	Y	Y	Y	Y	N
C2	Deformed bars or deformed wire?	Y	Y	N	N	N	I
C3	$d/2 \geq \max[\text{BDLF}, 12, 24\ d_b]$?	Y	N	I	Y	N	I
C4	$d/2 \geq \max[\text{BDLF}, 24\ d_b]$?	I	I	Y	N	N	I
A1	Provisions = satisfied	X		X			
A2	Provisions ≠ satisfied		X		X	X	
A3	DLT 12.14(d)						X
A4	DLT 12.14(h)	X	X	X	X	X	

Comments: 1) DLT 12.14(c) covers Section 12.14.2.2.

2) It was assumed that both limits (12 in. and 24 d_b) apply to deformed bars or wire. The phraseology in the Code is ambiguous.

Datum 12.14(d)	Source	Label	Number
If web reinforcement bends around longitudinal reinforcement.	X		
If bar size $\leq$ #5 or wire size $\leq$ D31.	X		
If bend angle $\geq$ 135 degrees.	X		

DLT 12.14(d) Small Bars or Wires - 1		1	2	3	4
C1	Bar size $\leq$ #5 or wire size $\leq$ D31?	Y	Y	Y	N
C2	Web reinforcement bends around longitudinal reinforcement?	Y	Y	N	I
C3	Bend angle $\geq$ 135 degrees?	Y	N	I	I
A1	Provision = satisfied	X			
A2	Provision $\neq$ satisfied		X		
A3	DLT 12.14(f)			X	X
A4	DLT 12.14(e)	X	X		

Comment: 1) DLT 12.14(d) partially covers Section 12.14.2.3.

Datum 12.14(e)	Source	Label	Number
Design yield stress in web reinforcement, psi.	X	f_{yd}	
Development length required, in.	DLT 12.2-12.9	BDLF	
Distance between mid-depth of member, d/2, and start of hook (point of tangency)	X	DTH	
Distance from extreme compression fiber to centroid of tension reinforcement.	X	d	

DLT 12.14(e)	Small Bars or Wires - 2	1	2	3
C1	$f_{yd} \leq 40000$?	Y	N	N
C2	DTH $\geq$ 0.33 BDLF?	I	Y	N
A1	Provision = satisfied	X	X	
A2	Provision $\neq$ satisfied			X
A3	DLT 12.14(h)	X	X	X

Comment:

1) DLT 12.14(e) partially covers Section 12.14.2.3.

Datum 12.14(f)	Source	Label	Number
If welded smooth wire fabric.	X		
If two longitudinal wires along the member at the top of the U.	X		
Spacing between two longitudinal wires at top of member, in.	X	S_w	

DLT 12.14(f)	Smooth Welded Wire Fabric - 1	1	2	3	4
C1	Welded smooth wire fabric?	Y	Y	Y	N
C2	Two longitudinal wires along the member at the top of the U?	Y	Y	N	I
C3	$S_w = 2$ in.?	Y	N	I	I
A1	Provision = satisfied	X			
A2	Provision ≠ satisfied				X
A3	DLT 12.14(g)		X	X	
A4	DLT 12.14(h)	X			X

Comments: 1) DLT 12.14(f) partially covers Section 12.14.2.4.

2) The reason for the difference between paragraphs (a) and (b) of Section 12.14.2.4 is not clear. Paragraph (b) seems to be a more specific form of (a) except that in paragraph (a) the spacing is given as exactly 2 in.

Datum 12.14(g)	Source	Label	Number
Distance from compression face to furthest longitudinal wire along top of member.	X	DTW	
If distance of the second wire, closer to the compression face $\geq$ 2 in. from the first wire.	X		
If wire is located on or beyond a bend.	X		
Inside diameter of bend.	X		
Distance from extreme compression fiber to centroid of tension reinforcement.	X	d	
Nominal diameter of bar, wire or prestressing strand.	X	d_b	

DLT 12.14(g)	Smooth WWF - 2	1	2	3	4	5	6
C1	DTW $\leq$ d/4?	Y	Y	Y	Y	Y	N
C2	Second wire, closer to compression face, $\geq$ 2 in. from first wire?	Y	Y	Y	N	N	I
C3	Wire located on or beyond a bend?	Y	Y	N	Y	N	I
C4	Inside diameter of bend $\geq$ 8 d_b?	Y	N	I	I	I	I
A1	Provision = satisfied	X		X			
A2	Provision ≠ satisfied		X		X	X	X
A3	DLT 12.14(h)	X	X	X	X	X	X

Comment: 1) DLT 12.14(g) partially covers Section 12.14.2.4.

Datum 12.14(h)	Source	Label	Number
If web reinforcement = simple U or multiple U stirrups.	X		
If each bend in continuous portion encloses a longitudinal bar.	X		

DLT 12.14(h)	Simple- or Multiple-U Stirrups	1	2	3
C1	Web reinforcement = simple or multiple U stirrups?	Y	Y	N
C2	Each bend in continuous portion encloses a longitudinal bar?	Y	N	I
A1	Provision = satisfied	X		
A2	Provision $\neq$ satisfied		X	
A3	DLT 12.14(i)	X	X	X

Comment: 1) DLT 12.14(h) covers Section 12.14.3.

Datum 12.14(i)	Source	Label	Number
If pairs of U-stirrups or ties so placed as to form a closed unit.	X		
Development length required, in.	DLT 12.2-12.9	BDLF	
Splice length provided, in.	X	SLP	

	DLT 12.14(i) Pairs of Stirrups or Ties - 1	1	2	3
C1	Pairs of U-stirrups or ties so placed as to form a closed unit?	Y	Y	N
C2	SLP $\geq$ 1.7 BDLF?	Y	N	I
A1	Provision = satisfied	X		
A2	Provision $\neq$ satisfied		X	
A3	DLT 12.14(j)		X	
A4	DLT Ch. 12	X		X

Comment: 1) DLT 12.14(i) partially covers Section 12.14.5.

Datum 12.14(j)	Source	Label	Number
Depth of member	X		
If stirrups extend full available depth of member.	X		
Area of individual bar, sq in.	X	A_b	
Specified yield strength of non-prestressed reinforcement, psi.	X	f_y	

DLT 12.14(j)	Pairs of U-Stirrups or Ties - 2	1	2	3	4
C1	Depth of member $\geq$ 18 in.?	Y	Y	Y	N
C2	$A_b f_y \leq$ 9000 lb per leg?	Y	Y	N	I
C3	Stirrup legs extend full available depth of member?	Y	N	I	I
A1	Provision = satisfied	X			
A2	Provision ≠ satisfied		X	X	X
A3	DLT 12.14(k)	X	X	X	X

Comment: 1) DLT 12.14(j) partially covers Section 12.14.5.

Datum 12.14(k)	Source	Label	Number
If longitudinal bars bent to act as shear reinforcement.	X		
If reinforcement extended into tension region.	X		
If longitudinal bent bars for shear reinforcement are continuous with longitudinal reinforcement.	X		

DLT 12.14(k) Longitudinal Bars - 1		1	2	3	4
C1	Longitudinal bars bent to act as shear reinforcement?	Y	Y	Y	N
C2	Reinforcement extended into tension region?	Y	Y	N	I
C3	Longitudinal bars for shear continuous with longitudinal reinforcement?	Y	N	I	I
A1	Provision = satisfied	X			
A2	Provision ≠ satisfied		X		
A3	DLT 12.14(ℓ)	X	X	X	
A4	DLT Ch. 12				X

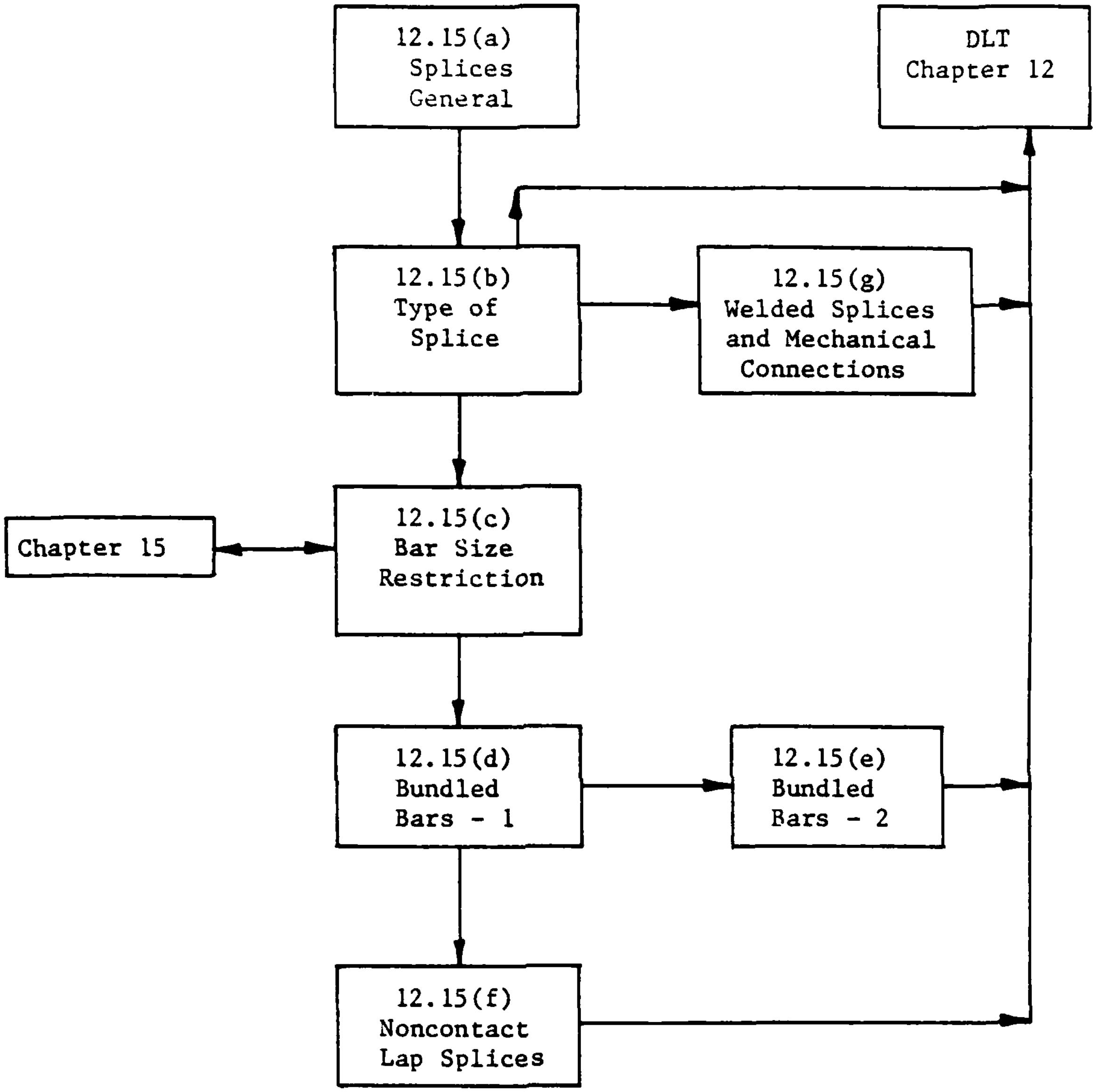
Comment: 1) DLT 12.14(k) partially covers Section 12.14.4.

Datum 12.14(ℓ)	Source	Label	Number
If reinforcement extended into a compression region.	X		
If anchored beyond mid-depth d/2 as specified for development length in Section 12.2.	X		

DLT 12.14(ℓ) Longitudinal Bars - 2		1	2	3	
C1	Reinforcement extended into compression region?	Y	Y	N	ELSE
C2	Anchored beyond mid-depth d/2 as specified for development length in Section 12.2?	Y	N		
A1	Provision = satisfied	X			
A2	Provision ≠ satisfied		X	X	
A3	DLT Ch. 12	X	X	X	
A4	Logical Error				X

Comment: 1) DLT 12.14(ℓ) partially covers Section 12.14.4.

Section 12.15 Map



Section 12.15 Splices of Reinforcement - General

Datum 12.15(a)	Source	Label	Number
If splices of reinforcement made only as required or permitted on design drawings, or in specifications, or as authorized by the Engineer.	X		

DLT 12.15(a)	Splices - General	1	2
C1	Splices of reinforcement made only as required or permitted on design drawings, or in specifications, or as authorized by the Engineer?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT 12.15(b)	X	X

Comment: 1) DLT 12.15(a) covers Section 12.15.1.

Datum 12.15(b)	Source	Label	Number
If splice type = lap.	X		
If splice type = welded splice or mechanical connection.	X		

DLT 12.15(b)	Type of Splice	1	2	3	
C1	Lap splice?	Y	N	N	ELSE
C2	Welded splice or mechanical connection?	N	Y	N	
A1	DLT 12.15(c)	X			
A2	DLT 12.15(g)		X		
A3	No Provision, DLT Ch. 12			X	
A4	Logical Error				X

Comment: 1) DLT 12.15(b) is a switching DLT.

Datum 12.15(c)	Source	Label	Number
Bar size.	X		
If splice = lap splice of column longitudinal bars in compression with footing dowels.	X		

DLT 12.15(c) Bar Size Restriction		1	2	3
C1	Bar size > #11?	Y	Y	N
C2	Splice = lap splice of column longitudinal bars in compression with footing dowels?	Y	N	I
A1	Chapter 15	X		
A2	Provision ≠ satisfied		X	
A3	DLT 12.15(d)	X	X	X

Comments: 1) DLT 12.15(c) covers Section 12.15.2.1.

Datum 12.15(d)	Source	Label	Number
Lap splice length required for individual bar.	DLT 12.16(a) DLT 12.17 (a,b,c)	SLR	
If three bar bundle.	X		
If four bar bundle.	X		

DLT 12.15(d) Bundled Bars - 1		1	2	3	
C1	Three bar bundle?	Y	N	N	ELSE
C2	Four bar bundle?	N	Y	N	
A1	SLR = 1.2 SLR	X			
A2	SLR = 1.33 SLR		X		
A3	DLT 12.15(f)			X	
A4	DLT 12.15(e)	X	X		
A5	Logical Error				X

Comment: 1) DLT 12.15(d) partially covers Section 12.15.2.2.

Datum 12.15(e)	Source	Label	Number
Lap splice length required.	DLT 12.15(d)	SLR	
Lap splice length used in design.	X	SLP	
If individual bar splices overlap.	X		

DLT 12.15(e) Bundled Bars - 2		1	2	3
C1	Individual bar splices overlap?	Y	N	N
C2	SLP $\geq$ SLR?	I	Y	N
A1	Provision = satisfied		X	
A2	Provision $\neq$ satisfied	X		
A3	DLT Ch. 12	X	X	X

Comment: 1) DLT 12.15(e) partially covers Section 12.15.2.2.

Datum 12.15(f)	Source	Label	Number
If bars spliced by noncontact lap splices.	X		
Transverse spacing between bars.	X	S_t	
Lap splice length required.	DLT 12.17(a,b,c) 12.16(a)	SLR	

DLT 12.15(f)	Noncontact Lap Splices	1	2	3	
C1	Bars spliced by noncontact lap splices?	Y	Y	N	ELSE
C2	$S_t \le \min\left[\frac{SLR}{5}, 6\right]$?	Y	N		
A1	Provision = satisfied	X			
A2	Provision ≠ satisfied		X		
A3	DLT Ch. 12	X	X	X	
A4	Logical Error				X

Comment: 1) DLT 12.15(f) covers Section 12.15.2.3.

Datum 12.15(g)	Source	Label	Number
If welding conforms to "Reinforcing Steel Welding Code" (AWS D12.1).	X		

DLT 12.15(g)	Welded Splices and Mechanical Connections	1	2
C1	Welding conforms to "Reinforcing Steel Welded Code" (AWS D12.1)?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT Chapter 12	X	X

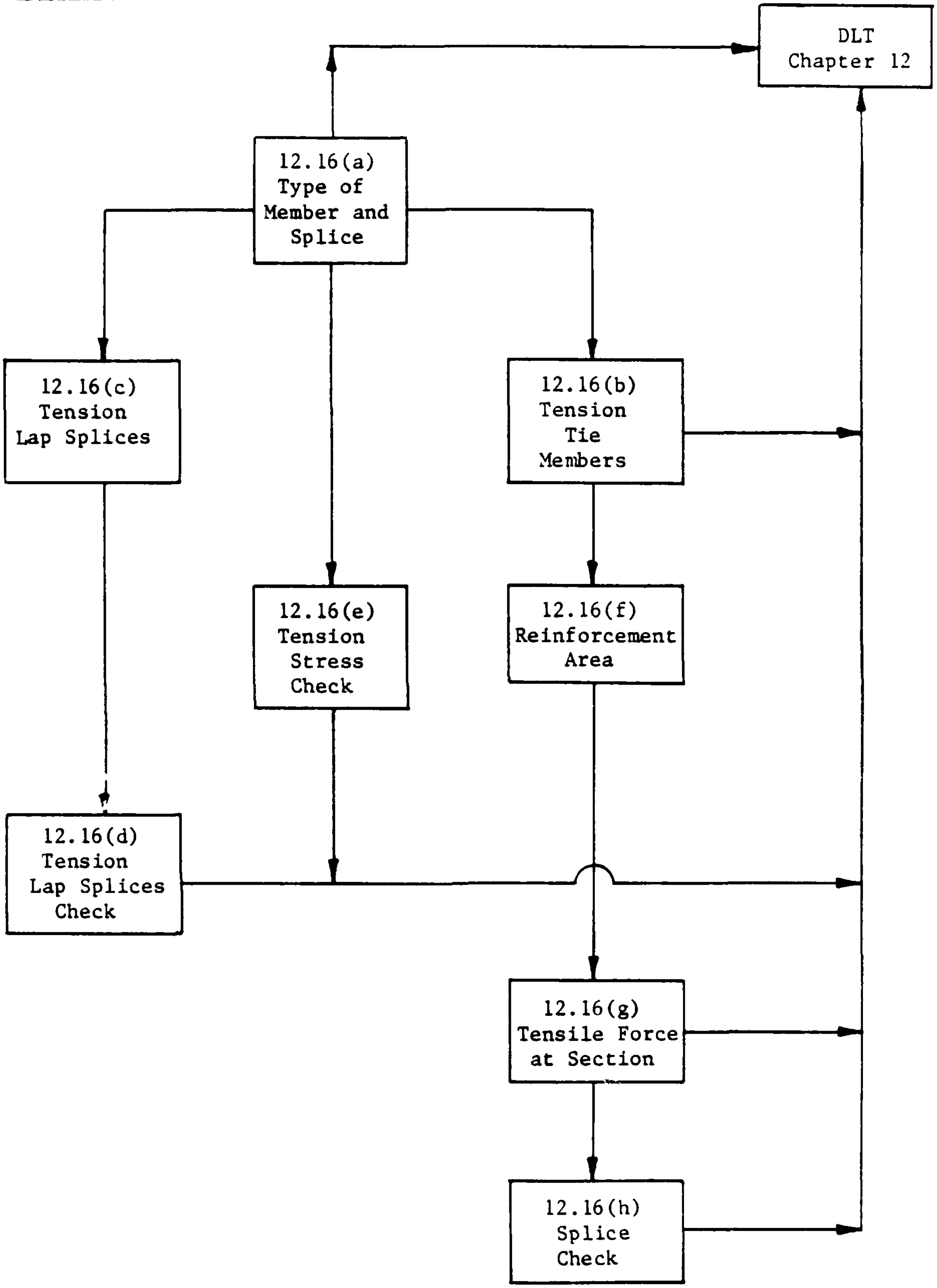
Comments:

1) DLT 12.15(g) covers Section 12.15.3.2.

2) Provisions of Sections 12.15.3.3, 12.15.3.4, and 12.15.3.5 are checked where applicable in portions of Sections 12.16, 12.17, and 12.18.

3) The phraseology of Section 12.15.3.2 implies that exceptions to AWS D12.1 exist in the Code. These are not apparent, hence this DLT does not reflect this possibility.

Section 12.16 Map



Section 12.16 Splices of Deformed Bars and Deformed Wire in Tension

Datum 12.16(a)	Source	Label	Number
If member is a tension-tie member.	X		
If splice type = lap.	X		
If splice type = welded or mechanical connection.	X		

DLT 12.16(a)	Type of Member and Splice	1	2	3	4	5	
C1	Tension tie member?	Y	Y	N	N	N	ELSE
C2	Splice type = lap?	I	N	Y	N	N	
C3	Splice type = welded or mechanical connection?	N	Y	N	Y	N	
A1	Provision = satisfied		X				
A2	Provision ≠ satisfied	X					
A3	DLT 12.16(b)		X				
A4	DLT 12.16(c)			X			
A5	DLT 12.16(e)				X		
A6	DLT Chapter 12	X				X	
A7	Logical Error						X

Comment:

1) DLT 12.16(a) partially covers Section 12.16.5 and is a switching table for splice type.

Datum 12.16(b)	Source	Label	Number
Specified yield strength of non-prestressed reinforcement, psi.	X	f_y	
Tension stress developed by welded splice or mechanical connection, psi.	X	f_{wm}	
Minimum distance between splices in adjacent bars.	X	DS	
Development length required, in.	DLT 12.2(f)	BDLF	

DLT 12.16(b)	Tension Tie Members	1	2	3
C1	$f_{wm} \geq 1.25\ f_y$?	Y	I	N
C2	DS $\geq$ 1.0 BDLF?	Y	N	Y
A1	Provision = satisfied	X		
A2	Provision ≠ satisfied		X	X
A3	DLT 12.16(f)			X
A4	DLT Ch. 12	X	X	

Comment: 1) DLT 12.16(b) covers Section 12.16.5, 12.15.3.3 and 12.15.3.4.

Datum 12.16(c)	Source	Label	Number
Area of nonprestressed tension reinforcement.	X	A_s	
Area of reinforcement required by analysis at splice location.	X	A_{sr}	
Maximum percent of A_s spliced within required lap length.	X	MPAS	
Development length required, in.	DLT 12.2(f)	BDLF	

DLT 12.16(c)	Tension Lap Splices	1	2	3	4	
C1	$A_s/A_{sr} \geq 2$?	Y	Y	N	N	E
C2	MPAS $\leq$ 50?	I	N	Y	N	L
C3	MPAS $\leq$ 75?	Y	N	Y	I	S
C4	MPAS $\leq$ 100?	Y	Y	Y	Y	E
A1	SLR = max[BDLF, 12]	X				
A2	SLR = max[1.3 BDLF, 12]		X	X		
A3	SLR = max[1.7 BDLF, 12]				X	
A4	DLT 12.16(d)	X	X	X	X	
A5	Logical Error					X

Comment: 1) DLT 12.16(c) partially covers Section 12.16.1 and 12.16.2.

Datum 12.16(d)	Source	Label	Number
Splice length required.	DLT 12.16(c)	SLR	
Splice length provided.	X	SLP	

DLT 12.16(d) Tension Lap Splice Check		1	2
C1	SLP $\geq$ SLR?	Y	N
A1	Provision = satisfied	X	
A2	Provision $\neq$ satisfied		X
A3	DLT Ch. 12	X	X

Comment: 1) DLT 12.16(d) partially covers Section 12.16.2 and 12.16.1.

Datum 12.16(e)	Source	Label	Number
Tension stress developed by welded splice or mechanical connection, psi.	X	f_{wm}	
Specified yield strength of non-prestressed tension reinforcement, psi.	X	f_y	

DLT 12.16(e)	Tension Stress Check	1	2
C1	$f_{wm} \geq 1.25\ f_y$?	Y	N
A1	Provision = satisfied	X	
A2	DLT 12.16(f)		X
A3	DLT Ch. 12	X	

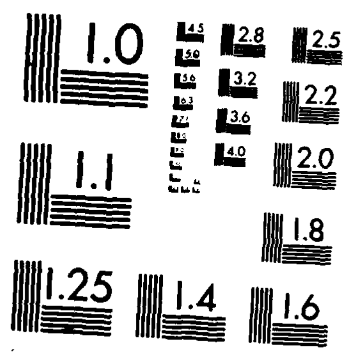
Comment: 1) DLT 12.16(e) covers Sections 12.16.3, 12.15.3.3 and 12.15.3.4.

Datum 12.16(f)	Source	Label	Number
Area of non-prestressed tension reinforcement, sq in.	X	A_s	
Area of reinforcement required by analysis.	X	A_{sr}	

DLT 12.16(f)	Reinforcement Area	1	2
C1	$A_s/A_{sr} \geq 2$?	Y	N
A1	Provision = satisfied		X
A2	DLT 12.16(g)	X	
A3	DLT Ch. 12		X

Comment: 1) DLT 12.16(f) covers Section 12.16.4.

AD-A173 728 COMPUTER-AIDED STRUCTURAL ENGINEERING (CASE) PROJECT 2/6
DECISION LOGIC TABL (U) ATKINSON-NOLAND & ASSOCIATES
INC BOULDER CO J L NOLAND JUL 86 ATC-TR-86-5-VOL-2
UNCLASSIFIED DACW39-82-M-3741 F/G 9/2 NL



MICROCOPY RESOLUTION TEST CHART
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Datum 12.16(g)	Source	Label	Number
If reinforcement is spliced.	X		
Shorter actual development length of unspliced reinforcement.	X	$\hat{\ell}$	
Specified yield strength of non-prestressed reinforcement.	X	f_y	
Area of individual bar, sq in.	X	A_{bi}	
Development length required, in.	DLT 12.2(f)	BDLF	

DLT 12.16(g) Tensile Force at Section		1	2
C1	Reinforcement spliced?	Y	N
A1	$\hat{f}_i = f_y$	X	
A2	$\hat{f}_i = \min\left[\frac{\hat{\ell}}{BDLF}(f_y),\ f_y\right]$		X
A3*	$CTF = \sum_{i=1}^{\#bars} A_{bi}\hat{f}_i$	X	X
A4	DLT 12.16(h)	X	X

Comment:

1) DLT 12.16(g) is a working DLT that covers Section 12.16.4.2.

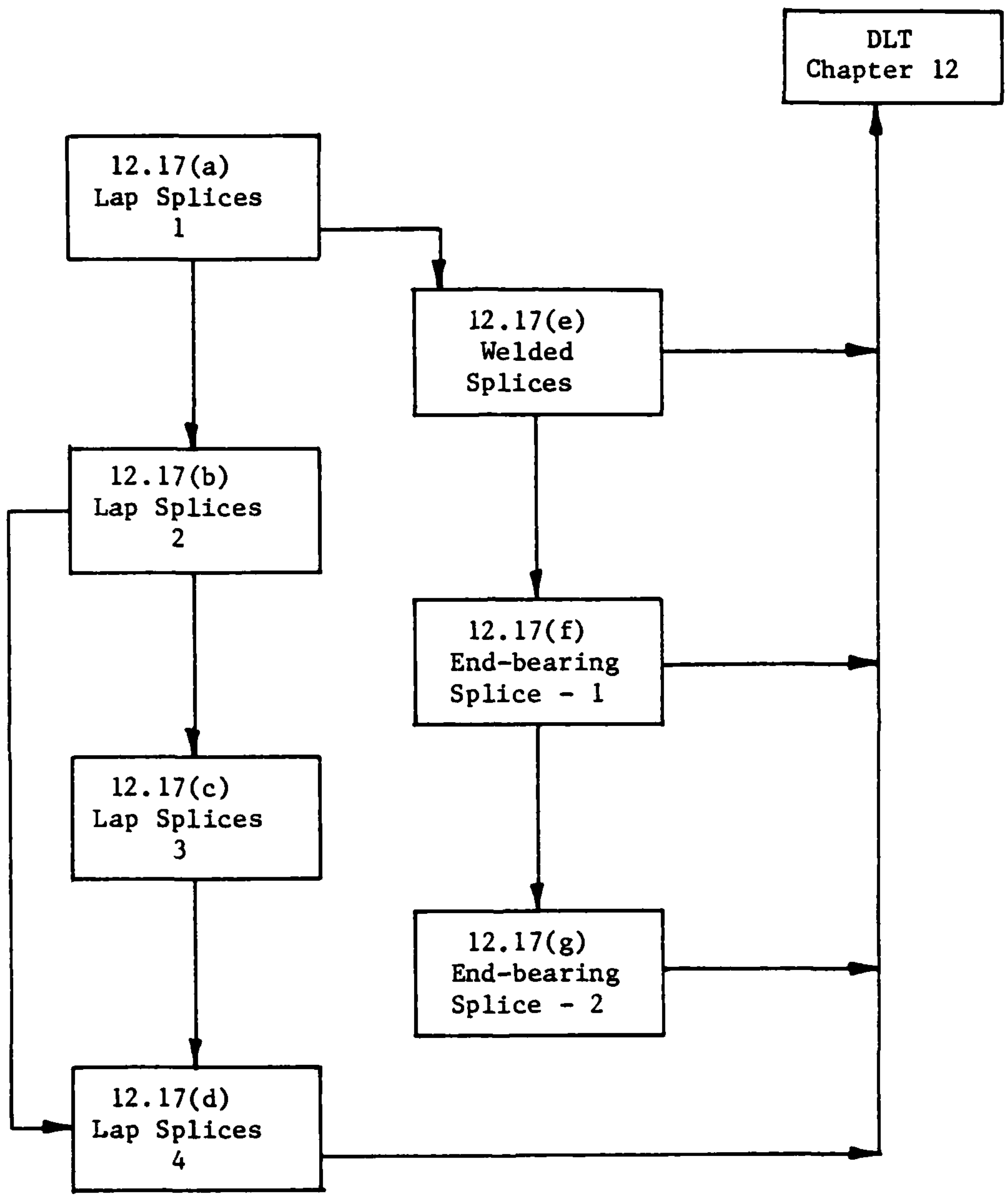
* The letter "i" in this DLT represents the i^{th} bar in the section. This DLT will have to be repeated for each bar.

Datum 12.16(h)	Source	Label	Number
If splices staggered at least 24 in.	X		
Computed tensile force developed at section.	DLT 12.16(e)	CTF	
Area of non-prestressed tension reinforcement.	X	A_s	
Calculated tensile force at section.	X	T_f	

DLT 12.16(h)	Splice Check	1	2	3	4
C1	CTF $\geq$ 2 T_f?	Y	Y	Y	N
C2	CTF/A_s $\geq$ 20000?	Y	Y	N	I
C3	Splices staggered at least 24 in.?	Y	N	I	I
A1	Provision = satisfied	X			
A2	Provision $\neq$ satisfied		X	X	X
A3	DLT Ch. 12	X	X	X	X

Comment: 1) DLT 12.16(h) covers Section 12.16.4.1.

Section 12.17 Map



Section 12.17 Splices of Deformed Bars in Compression

Datum 12.17(a)	Source	Label	Number
Required development length in compression.	DLT 12.3(a)	BDLF	
Specified yield strength of non-prestressed reinforcement, psi.	X	f_y	
Specified compressive strength of concrete, psi.	X	f'_c	
Nominal diameter of bar, wire, or prestressing strand, in.	X	d_b	
If type of splice = lap.	X		

DLT 12.17(a) Lap Splice - 1		1	2	3	4	5
C1	Type of splice = lap?	Y	Y	Y	Y	N
C2	$f_y > 60000$?	Y	Y	N	N	I
C3	$f'_c < 3000$?	Y	N	Y	N	I
A1	SLR = max$[\text{BDLF}, 0.0005\ f_y d_b, 12]$				X	
A2	SLR = max$[\text{BDLF}, (0.0009\ f_y - 24) d_b, 12]$		X			
A3	SLR = 1.333 max$[\text{BDLF}, 0.0005\ f_y d_b, 12]$			X		
A4	SLR = 1.333 max$[\text{BDLF}, (0.0009\ f_y - 24) d_b, 12]$	X				
A5	DLT 12.17(b)	X	X	X	X	
A6	DLT 12.17(e)					X

Comment:

1) DLT 12.17(a) partially covers Section 12.17.1.

Datum 12.17(b)	Source	Label	Number
If tied reinforced compression member.	X		
If ties throughout lap splice length.	X		
Required lap splice length.	DLT 12.17(a)	SLR	
Effective area of ties.*	X		
Overall thickness of member, in.	X	h	
Spacing of stirrups or ties, in.	X	s	

DLT 12.17(b)	Lap Splice - 2	1	2	3	4	5	
C1	Tied reinforced compression member?	Y	Y	Y	Y	N	ELSE
C2	Ties throughout lap splice length?	Y	Y	N	N		
C3	Effective area of ties $\geq$ 0.0015 hs?	Y	N	Y	N		
A1	SLR = max[0.83 SLR, 12]	X					
A2	DLT 12.17(c)					X	
A3	DLT 12.17(d)	X	X	X	X		
A4	Logical Error						X

Comment:

1) DLT 12.17(b) covers Section 12.17.2.

* Tie legs perpendicular to dimension h shall be used in determining effective area.

Datum 12.17(c)	Source	Label	Number
If spirally reinforced compression member.	X		
If lap splice length within spiral.	X		
Lap splice length required.	DLT 12.17(a)	SLR	

DLT 12.17(c) Lap Splice - 3		1	2	3
C1	Spirally reinforced compression member?	Y	Y	N
C2	Bars within a spiral?	Y	N	I
A1	SLR = max[.75 SLR, 12]	X		
A2	DLT 12.17(d)	X	X	X

Comments:

1) DLT 12.17(c) covers Section 12.17.3.

2) This DLT admits the possibility that bars may be outside the spiral. This may not be a legitimate possibility, but is included because of the phraseology used in Section 12.17.3.

Datum 12.17(d)	Source	Label	Number
Lap splice length required.	DLT 12.17 (a,b,c)	SLR	
Lap splice length used in design.	X	SLP	

DLT 12.17(d) Lap Splice - 4		1	2
C1	SLP $\geq$ SLR?	Y	N
A1	Provision = satisfied	X	
A2	Provision $\neq$ satisfied		X
A3	DLT Ch. 12	X	X

Comment: 1) DLT 12.17(d) partially covers Sections 12.17.1, 12.17.2 and 12.17.3.

Datum 12.17(e)	Source	Label	Number
If welded splice.	X		
If mechanical connection.	X		
Tension stress developed by welded splice or mechanical connection.	X	f_{wm}	
Compression developed by mechanical connection.	X	C_m	
Specified yield strength of non-prestressed reinforcement, psi.	X	f_y	

DLT 12.17(e)	Welded Splice	1	2	3	4	5	6	
C1	Welded splice?	Y	Y	N	N	N	N	E
C2	Mechanical connection?	N	N	Y	Y	Y	N	L
C3	$f_{wm} \geq 1.25\ f_y$?	Y	N	Y	Y	N	I	S
C4	$C_m \leq -1.25\ f_y$?	I	I	Y	N	I	I	E
A1	Provision = satisfied	X		X				
A2	Provision ≠ satisfied		X		X	X		
A3	DLT Ch. 12	X	X	X	X	X		
A4	DLT 12.17(f)						X	
A5	Logical Error							X

Comment: 1) DLT 12.17(e) covers Section 12.17.4, 12.15.3.3 and 12.15.3.4.

Datum 12.17(f)	Source	Label	Number
If end bearing splice used.	X		
If reinforcement in compression only.	X		
If member contains closed ties, closed stirrups or spirals.	X		
If compressive stress is transmitted by bearing of square cut ends held in concentric contact.	X		

DLT 12.17(f)	End-Bearing Splices - 1	1	2	3	4	5
C1	End-bearing splices used?	Y	Y	Y	Y	N
C2	Reinforcement in compression only?	Y	Y	Y	N	I
C3	Member contains closed ties, closed stirrups, or spirals?	Y	Y	N	I	I
C4	Compressive stress is transmitted by bearing of square cut ends held in concentric contact?	Y	N	I	I	I
A1	Provision = satisfied	X				
A2	Provision ≠ satisfied		X	X	X	
A3	DLT 12.17(g)	X	X	X	X	
A4	No Provision, DLT Ch. 12					X

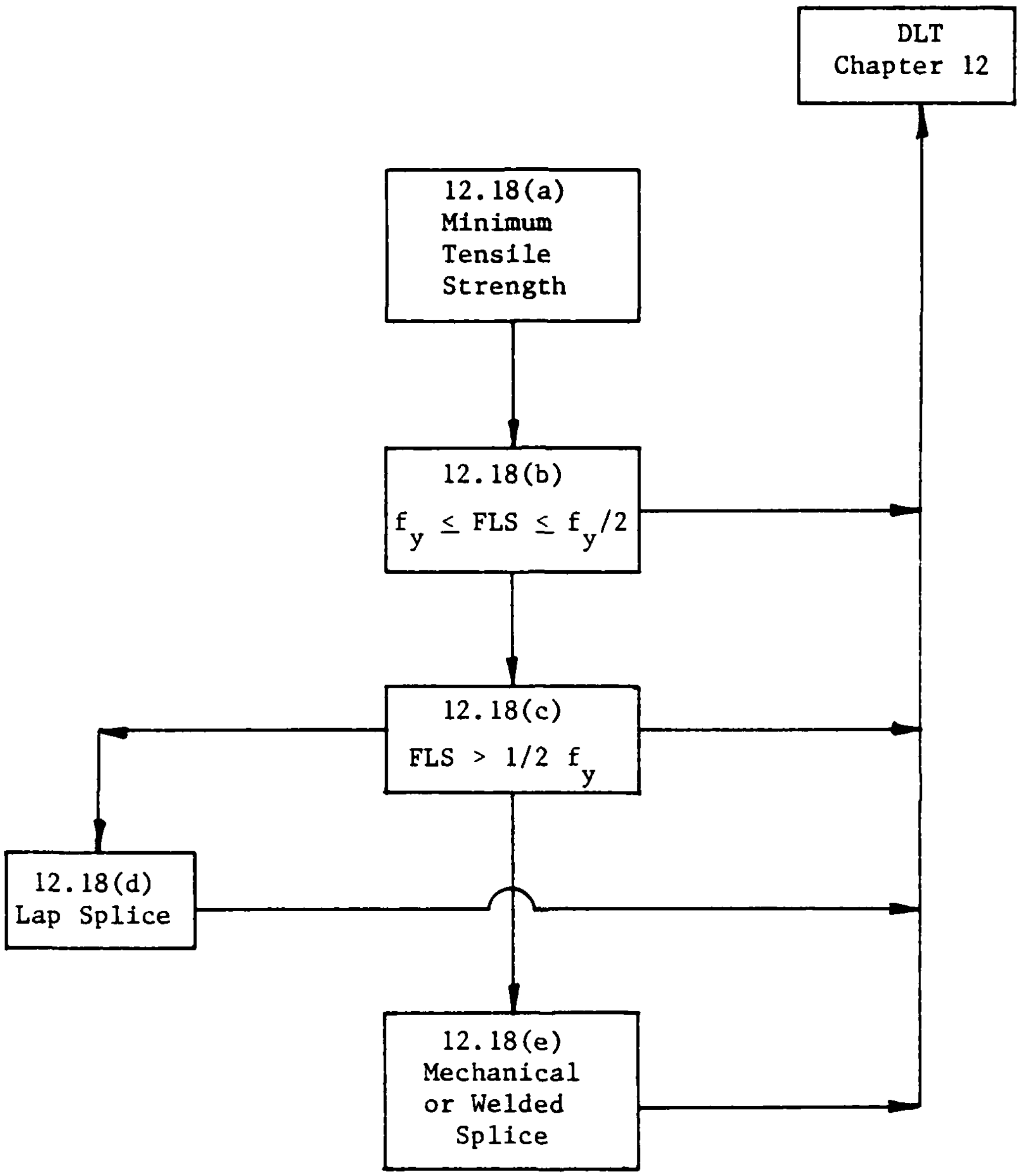
Comment: 1) DLT 12.17(f) covers Sections 12.17.5.1 and 12.17.5.3.

Datum 12.17(g)	Source	Label	Number
If bar ends terminate in flat surfaces.	X		
Angle between axis of bar and surface.	X		
If bar fitted within 3 degrees of full bearing after assembly.	X		

DLT 12.17(g) End-Bearing Splice - 2		1	2	3	4
C1	Bar terminates in flat surface?	Y	Y	Y	N
C2	Angle between axis of bar and surface > $88\frac{1}{2}^{\circ}$?	Y	Y	N	I
C3	Bar fitted within 3 degrees of full bearing after assembly?	Y	N	I	I
A1	Provision = satisfied	X			
A2	Provision ≠ satisfied		X	X	X
A3	DLT Ch. 12	X	X	X	X

Comment: 1) DLT 12.17(g) covers Section 12.17.5.2.

Section 12.18 Map



Section 12.18 Special Splice Requirements for Columns

Datum 12.18(a)	Source	Label	Number
Tensile strength in each face of horizontal cross sections of columns where splices are located, lb.	X	TS	
Specified yield strength of non-prestressed reinforcement, psi.	X	f_y	
Area of vertical reinforcement in face of column.	X	A_{sv}	

DLT 12.18(a)	Minimum Tensile Strength	1	2
C1	$TS \geq (A_{sv}/4)f_y$?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT 12.18(b)	X	X

Comment: 1) DLT 12.18(a) covers Section 12.18.3.

Datum 12.18(b)	Source	Label	Number
Factored load stress in longitudinal bars in a column.*	X	FLS	
Specified yield strength of non-prestressed reinforcement, psi.	X	f_y	
If splice type = lap splices, butt welded splices, mechanical connections or end-bearing splices.	X		
Total tensile strength provided in each face of column by splices alone or by splices in combination with continuing on spliced bars at specified yield strength, f_y, (lbs).	X	TSP	
Calculated tension in the face of the column, lbs.	X	TSC	
Area of vertical reinforcement in face of the column.	X	A_{sv}	

DLT 12.18(b)	$-f_y \le FLS \le f_y/2$	1	2	3	4
C1	$-f_y$ (in compression) $\le$ FLS $\le 1/2\ f_y$ (tension)?	Y	Y	Y	N
C2	Splice type = lap splices, butt welded splices, mechanical connections or end-bearing splices?	Y	Y	N	I
C3	$TSP \ge \max\left[2\ TSC, \frac{A_{sv}}{4} f_y\right]$?	Y	N	I	I
A1	Provision = satisfied	X			
A2	Provision ≠ satisfied		X	X	
A3	DLT Chapter 12	X	X	X	
A4	DLT 12.18(c)				X

Comments:

1) DLT 12.18(b) covers Section 12.18.1.

2) It is assumed that one of the splice types given in 12.18.1 must be used to satisfy Code requirements.

---

* Calculated for various loading combinations.

Datum 12.18(c)	Source	Label	Number
Factored load stress for longitudinal bars in a column.	X	FLS	
Specified yield strength of non-prestressed reinforcement, psi.	X	f_y	
If lap splice used.	X		
If full welded splice or mechanical connection.	X		

DLT 12.18(c) FLS > $f_y/2$		1	2	3	4	
C1*	FLS > 1/2 f_y (in tension)?	Y	Y	Y	N	E L S E
C2	Lap splice used?	Y	N	N		
C3	Mechanical connection or full welded splice used?	N	Y	N		
A1	Provision = satisfied	X	X			
A2	Provision ≠ satisfied			X		
A3	No Provision				X	
A4	DLT 12.18(d)	X				
A5	DLT 12.18(e)		X			
A6	DLT Chapter 12			X	X	
A7	Logical Error					X

Comment:

1) DLT 12.18(c) partially covers Section 12.18.2.

* If C1 is N , then FLS must be greater than f_y in compression for which there is no provision.

Datum 12.18(d)	Source	Label	Number
Tensile strength developed by lap splice, psi.	X	T_{ℓ}	
Specified yield strength of non-prestressed reinforcement.	X	f_y	

DLT 12.18(d) Lap Splice		1	2
C1	$T_{\ell} \geq f_y$?	Y	N
A1	Provision = satisfied	X	
A2	Provision $\neq$ satisfied		X
A3	DLT Ch. 12	X	X

Comment: 1) DLT 12.18(d) partially covers Section 12.18.2.

DLT 12.18(e)	Source	Label	Number
Tension stress developed by welded splice or mechanical connection.	X	f_{wm}	
Specified yield strength of non-prestressed reinforcement, psi.	X	f_y	

DLT 12.18(e)	Mechanical or Welded Splice	1	2
C1	$f_{wm} \geq 1.25\ f_y$?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT Ch. 12	X	X

Comment: 1) DLT 12.18(e) partially covers Section 12.18.2 and Sections 12.5.3.3 and 12.5.3.4.

Section 12.19 Map

Section 12.19 Splices of Welded Deformed Wire Fabric in Tension

Datum 12.19(a)	Source	Label	Number
If cross wires within lap splice length.	X		
Overlap measured between outermost cross wires, in.	X	S_c	
Development length required, in.	DLT 12.8(b)	BDLF	
Lap splice length used in design measured between ends of each fabric, in.	X	SLU	

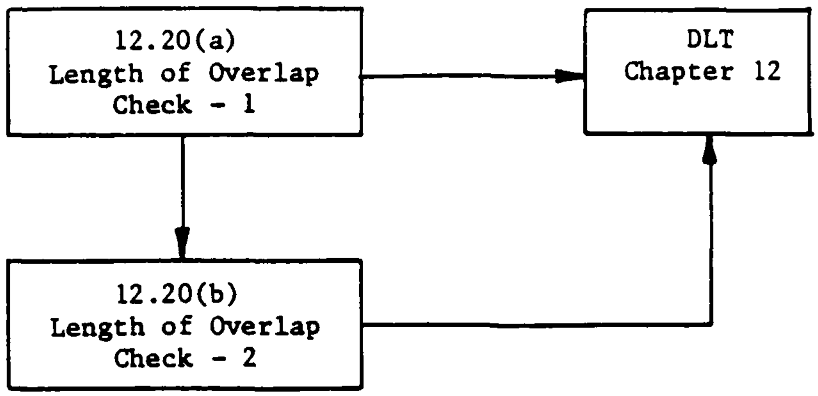
DLT 12.19(a)	Length and Overlap Check	1	2	3	4
C1	Cross wire within lap splice?	Y	Y	Y	N
C2	$S_c > 2$ in.?	Y	Y	N	I
C3	$SLU \geq \max[1.7\ BDLF,\ 8]$	Y	N	I	I
A1	Provision = satisfied	X			
A2	Provision ≠ satisfied		X	X	
A3*	DLT 12.16(a)				X
A4	DLT Chapter 12	X	X	X	

Comment:

1) DLT 12.19(a) covers Sections 12.19.1 and 12.19.2.

* A3 transfers control to the DLT that covers deformed wire.

Section 12.20 Map



Section 12.20 Splices of Welded Smooth Wire Fabric in Tension

Datum 12.20(a)	Source	Label	Number
Area of non-prestressed tension reinforcement provided at splice location, sq in.	X	A_s	
Area of non-prestressed tension reinforcement required by analysis at splice location.	X	A_{sr}	
Length of overlap measured between outermost cross wires.	X	OL	
Development length required, in.	DLT 12.9(a)	BDLF	

DLT 12.20(a)	Length of Overlap Check - 1	1	2	3
C1	$A_s/A_{sr} \geq 2$?	Y	Y	N
C2	OL $\geq$ max$\left[1.5 \text{ BDLF}, 2\right]$?	Y	N	I
A1	Provision = satisfied	X		
A2	Provision $\neq$ satisfied		X	
A3	DLT 12.20(b)			X
A4	DLT Chapter 12	X	X	

Comment:

1) DLT 12.20(a) covers Section 12.20.2.

Datum 12.20(b)	Source	Label	Number
Length of overlap measured between outermost cross wire, in.	X	OL	
Length of one spacing of cross wires, in.	X	CWS	
Development length required, in.	DLT 12.9(a)	BDLF	

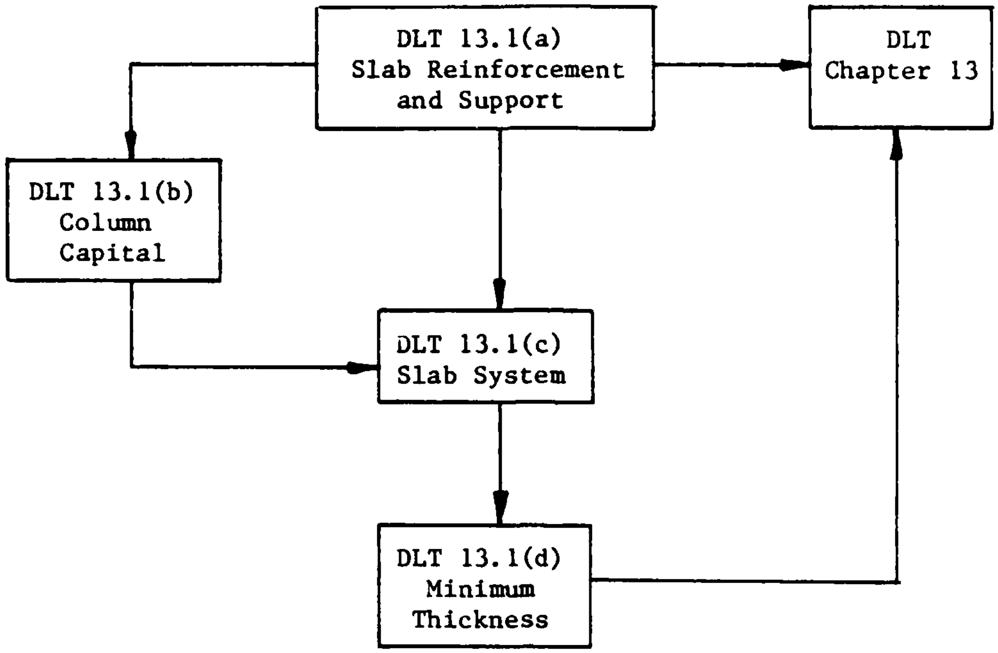
DLT 12.20(b) Length of Overlap Check - 2		1	2
C1	OL $\geq$ max$\left[(CWS + 2),\ 1.5\ BDLF,\ 6\right]$?	Y	N
A1	Provision = satisfied	X	
A2	Provision $\neq$ satisfied		X
A3	DLT Ch. 12	X	X

Comment: 1) DLT 12.20(b) covers Section 12.20.1.

ACI CHAPTER 13: TWO-WAY SLAB SYSTEM

DLT Chapter 13		1	2	3	4	5	6	7	8	9
C1	Scope?	Y	N	N	N	N	N	N	N	
C2	Definitions?	N	Y	N	N	N	N	N	N	E
C3	Design procedures?	N	N	Y	N	N	N	N	N	L
C4	Slab reinforcement?	N	N	N	Y	N	N	N	N	S
C5	Openings in slabs?	N	N	N	N	Y	N	N	N	E
C6	Direct Design Method?	N	N	N	N	N	Y	N	N	
C7	Equivalent Frame Method?	N	N	N	N	N	N	Y	N	
A1	Section 13.1	X								
A2	Section 13.2		X							
A3	Section 13.3			X						
A4	Section 13.4				X					
A5	Section 13.5					X				
A6	Section 13.6						X			
A7	Section 13.7							X		
A8	DLT 318-77 Index								X	
A9	Logical Error									X

Section 13.1 Map



Section 13.1 Scope

Datum 13.1(a)	Source	Label	Number
If slab systems reinforced for flexure in more than one direction with or without beams between supports.	X		
If slab system supported by walls.	X		
If slab system supported by columns.	X		

DLT 13.1(a) Slab Reinforcement & Support		1	2	3
C1	Slab systems reinforced for flexure in more than one direction with or without beams between supports?	Y	Y	N
C2	Slab system supported by walls?	I	I	I
C3	Slab system supported by columns?	Y	N	I
A1	Provisions of Ch. 13 apply	X	X	
A2	DLT 13.1(b)	X		
A3	DLT 13.1(c)		X	
A4	DLT Chapter 13			X

Comment: 1) DLT 13.1(a) covers Section 13.1.1 and partially covers Section 13.1.2.

Datum 13.1(b)	Source	Label	Number
If portion of column capital considered for structural purposes lies outside the largest right circular cone or pyramid with a 90° vertex that can be included within the outlines of the supporting element.	X		

DLT 13.1(b) Column Capital		1	2
C1	If portion of column capital considered for structural purposes that lies outside the largest right circular cone or pyramid with a 90° vertex that can be included within the outline of the supporting element?	Y	N
A1	Provision = satisfied		X
A2	Provision ≠ satisfied	X	
A3	DLT 13.1(c)	X	X

Comment: 1) DLT 13.1(b) covers Section 13.1.2.

Datum 13.1(c)	Source	Label	Number
If slab system is solid, slabs and slabs with recesses or pockets made by permanent or removable fillers between ribs or joists in two directions.	X		
If slab system contains panelled ceilings.	X		
If panel of reduced thickness lies entirely within middle strips and is not less than 2/3 the thickness of the remainder of the slab, exclusive of the drop panel, nor less than 4" thick.	X		

DLT 13.1(c) Slab System		1	2	3	4	
C1	Slab system = solid slabs and slabs with recesses or pockets made by permanent or removable fillers between ribs or joists in two directions?	Y	N	N	N	E L
C2	Slab system contains panelled ceilings?	N	Y	Y	N	S
C3	Panel of reduced thickness lies entirely within middle strips and is $\geq 2/3$ the thickness of the remainder of the slab, exclusive of the drop panel, nor less than 4" thick?		Y	N		E
A1	Provisions of Chapter 13 apply.	X	X			
A2	Provisions of Chapter 13 do not apply			X	X	
A3	DLT Ch. 13			X	X	
A4	DLT 13.1(d)	X	X			
A5	Logical Error					X

Comments: 1) DLT 13.1(c) covers Sections 13.1.3 and 13.1.4.

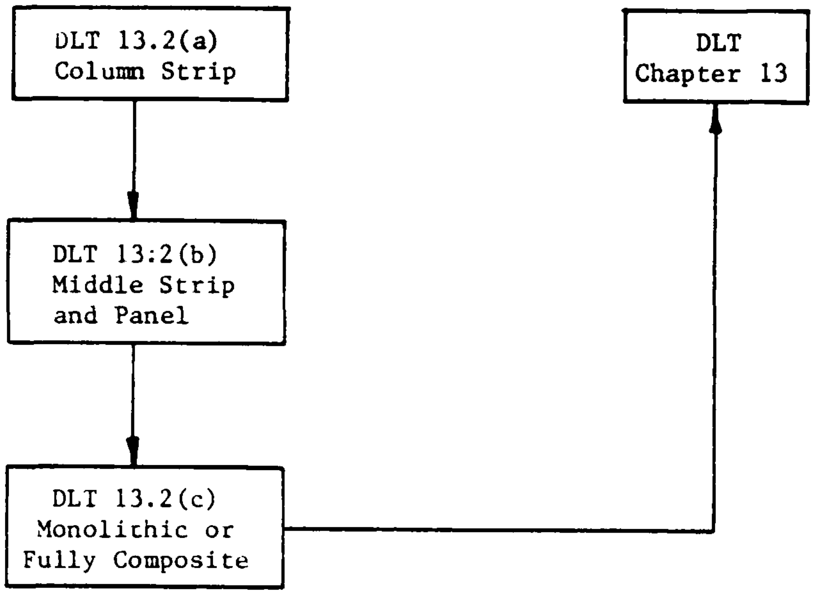
2) It is assumed here that the panels of reduced thickness in slabs with panelled ceilings do not contain recesses or pockets.

Datum 13.1(d)	Source	Label	Number
If minimum thickness of slabs designed in accordance with Chapter 13 as required by Section 9.5.3.	X		

DLT 13.1(d)	Minimum Thickness	1	2
C1	Minimum thickness of slabs designed in accordance with Chapter 13 as required by Section 9.5.3?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT Ch. 13	X	X

Comments: 1) DLT 13.1(d) covers Section 13.1.5.

Section 13.2 Map



Section 13.2 Definitions

Datum 13.2(a)	Source	Label	Number
If the column strip used in the analysis is a design strip with a width on each side of a column center line equal to 0.25 ℓ_2 or 0.25 ℓ_1, whichever is less.	X		
If column strip includes beams (if any).	X		

DLT 13.2(a) Column Strip		1	2	3
C1	The column strip used in the analysis is a design strip with a width on each side of a column center line equal to 0.25 ℓ_2 or 0.25 ℓ_1, whichever is less?	Y	Y	N
C2	Column strip includes beams (if any)?	Y	N	I
A1	Provision = satisfied	X		
A2	Provision ≠ satisfied		X	X
A3	DLT 13.2(b)	X	X	X

Comment: 1) DLT 13.2(a) covers Section 13.2.1.

Datum 13.2(b)	Source	Label	Number
If the middle strip used in the analysis is a design strip bounded by two column strips.	X		
If a panel used in the analysis is bounded by column, beam, or wall center lines on all sides.	X		

DLT 13.2(b)	Middle Strip of Panel	1	2	3
C1	The middle strip used in the analysis a design strip bounded by two column strips?	Y	Y	N
C2	A panel used in the analysis bounded by column, beam or wall center line on all sides?	Y	N	I
A1	Provision = satisfied	X		
A2	Provision ≠ satisfied		X	X
A3	DLT 13.2(c)	X	X	X

Comment:

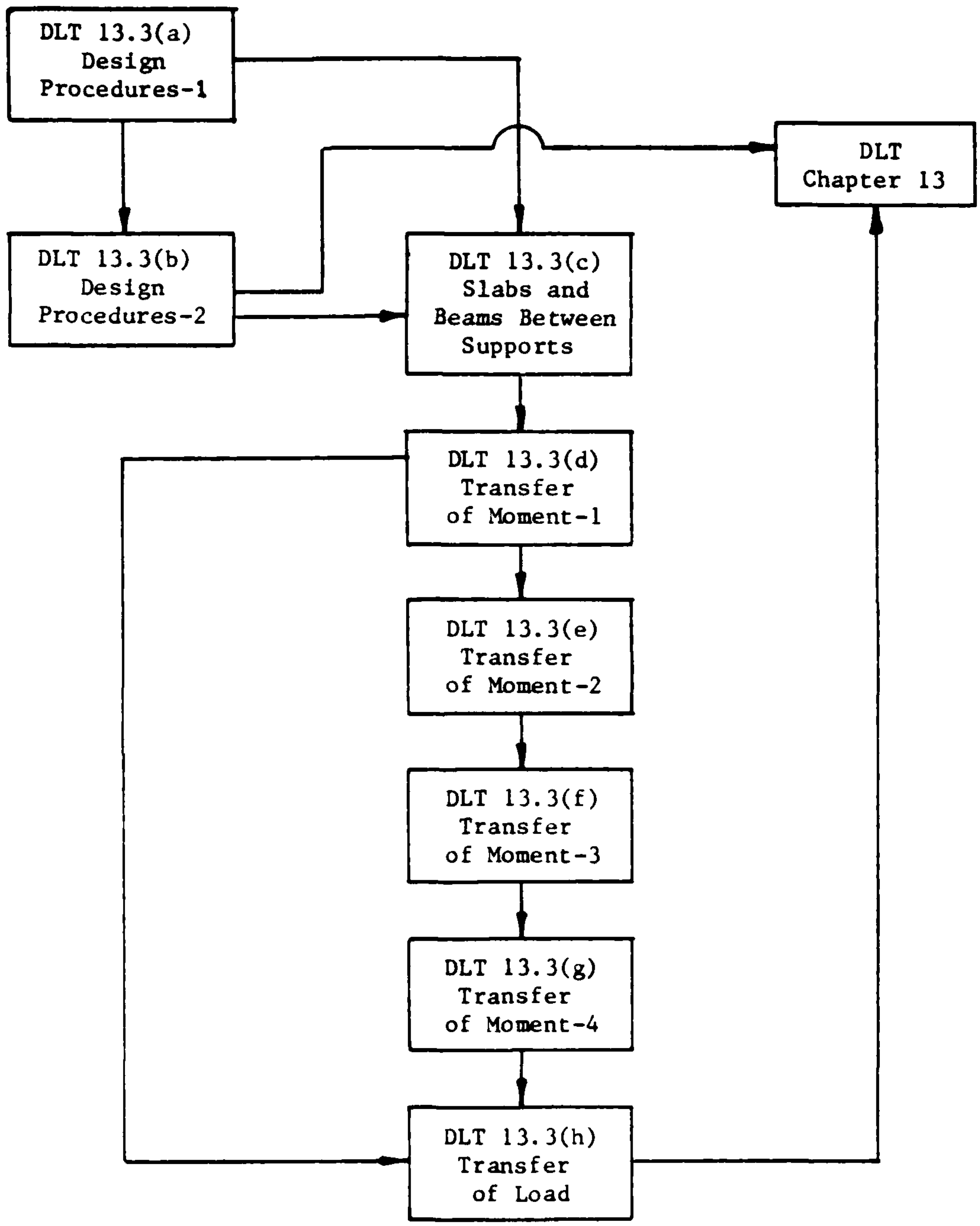
1) DLT 13.2(b) covers Sections 13.2.2 and 13.2.3.

Datum 13.2(c)	Source	Label	Number
If monolithic or fully composite construction.	X		
If beam includes that portion of slab on each side of the beam extending a distance equal to the projection of the beam above or below the slab, whichever is greater, but $\leq$ 4 times the slab thickness.	X		

DLT 13.2(c) Monolithic or Fully Composite		1	2	3
C1	Monolithic or fully composite construction?	Y	Y	N
C2	Beam includes that portion of slab on each side of the beam extending a distance equal to the projection of the beam above or below the slab, whichever is greater, but $\leq$ 4 times the slab thickness?	Y	N	I
A1	Provision = satisfied	X		
A2	Provision $\neq$ satisfied		X	
A3	DLT Ch. 13	X	X	X

Comment: 1) DLT 13.2(c) covers Section 13.2.4.

Section 13.3 Map



Section 13.3 Design Procedures

Datum 13.3(a)	Source	Label	Number
If the slab system, including the slab and beams (if any) were designed by the Direct-Design Method (Section 13.6) or by the Equivalent Frame Method (Section 13.7).	X		

DLT 13.3(a) Design Procedure-1		1	2
C1	Slab system, including the slab and beams (if any) designed by the Direct-Design Method (Section 13.6) or the Equivalent Frame Method (Section 13.7)?	Y	N
A1	DLT 13.3(b)		X
A2	DLT 13.3(c)	X	

Comments: 1) DLT 13.3(a) covers Section 13.3.2.

Datum 13.3(b)	Source	Label	Number
If slab system designed to satisfy conditions of equilibrium and geometrical compatibility.	X		
If design strength at every section is at least equal to the required strength considering Sections 9.2 and 9.3.	X		
If design satisfies all serviceability conditions including specified limits on deflection.	X		

DLT 13.3(b) Design Procedure-2		1	2	3	4
C1	Slab system designed to satisfy conditions of equilibrium and geometrical compatibility?	Y	Y	Y	N
C2	Design strength at every Section is at least equal to the required strength considering Sections 9.2 and 9.3?	Y	Y	N	I
C3	Design satisfies all serviceability conditions including specified limits on deflection?	Y	N	I	I
A1	Provision = satisfied	X			
A2	Provision ≠ satisfied		X	X	X
A3	DLT 13.3(c)	X			
A4	DLT Chapter 13		X	X	X

Comment: 1) DLT 13.3(b) covers Section 13.3.1.

Datum 13.3(c)	Source	Label	Number
If slab and beams (if any) between supports proportioned for factored moments prevailing at every section.	X		

DLT 13.3(c)	Slabs and Beams Between Supports	1	2
C1	Slab and beams (if any) between supports proportioned for factored moments prevailing at every section?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT 13.3(d)	X	X

Comment: 1) DLT 13.3(c) covers Section 13.3.3.

Datum 13.3(d)	Source	Label	Number
If gravity load, wind, earthquake or other lateral forces cause transfer of moment between slab and column.	X		
Distance from extreme compression fiber to centroid of tension reinforcement, in.	X	d	
Size of rectangular or equivalent rectangular column, capital, or bracket measured in the direction of the span for which moments are being determined, in.	X	c_1	
Size of rectangular or equivalent rectangular column, capital, or bracket measured transverse to the direction of the span for which moments are being determined, in.	X	c_2	

DLT 13.3(d) Transfer of Moment-1		1	2
C1	Gravity load, wind, earthquake or other lateral forces cause transfer of moment between slab and column?	Y	N
A1	$\gamma_t = \dfrac{1}{1 + \frac{2}{3}\sqrt{\frac{c_1+d}{c_2+d}}}$	X	
A2	DLT 13.3(e)	X	
A3	DLT 13.3(h)		X

Comment: 1) DLT 13.3(d) partially covers Section 13.3.4 and 13.3.4.2.

Datum 13.3(e)	Source	Label	Number
Total moment transferred between slab and column.	X	TM	
Unbalanced moment considered transferred by flexure.	X	UMF	
If unbalanced moment transferred over an effective slab width between lines that are one and one-half slab or drop panel thickness (1.5 h) outside opposite face of column or capital.	X		
Fraction of unbalanced moment transferred by flexure at slab-column connections.	DLT 13.3(c)	γ_t	

DLT 13.3(e)	Transfer of Moment-2	1	2	3
C1	UMF = γ_tTM?	Y	Y	N
C2	Unbalanced moment transferred over an effective slab width between lines that are one and one-half slab or drop panel thickness (1.5 h) outside opposite face of column or capital?	Y	N	I
A1	Provision = satisfied	X		
A2	Provision ≠ satisfied		X	X
A3	DLT 13.3(f)	X	X	X

Comment: 1) DLT 13.3(e) covers Section 13.3.4.2.

Datum 13.3(f)	Source	Label	Number
If concentration of reinforcement over the column by closer spacing or additional reinforcement used to resist moment.	X		
If the concentration of reinforcement or additional reinforcement within effective slab width, 1.5 h, outside opposite faces of the column or capital.	X		

DLT 13.3(f) Transfer of Moment-3		1	2	3
C1	Concentration of reinforcement over the column by closer spacing or additional reinforcement used to resist moment?	Y	Y	N
C2	Concentration of reinforcement or additional reinforcement within effective slab width, 1.5 h, outside opposite faces of the column or capital?	Y	N	I
A1	Provision = satisfied	X		X
A2	Provision ≠ satisfied		X	
A3	DLT 13.3(g)	X	X	X

Comment: 1) DLT 13.3(f) covers Section 13.3.4.3.

Datum 13.3(g)	Source	Label	Number
If fraction of unbalanced moment not transferred by flexure transferred by eccentricity of shear in accordance with Section 11.12.2.	X		

DLT 13.3(g)	Transfer of Moment	1	2
C1	Fraction of unbalanced moment not transferred by flexure transferred by eccentricity of shear in accordance with Section 11.12.2?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT 13.3(h)	X	X

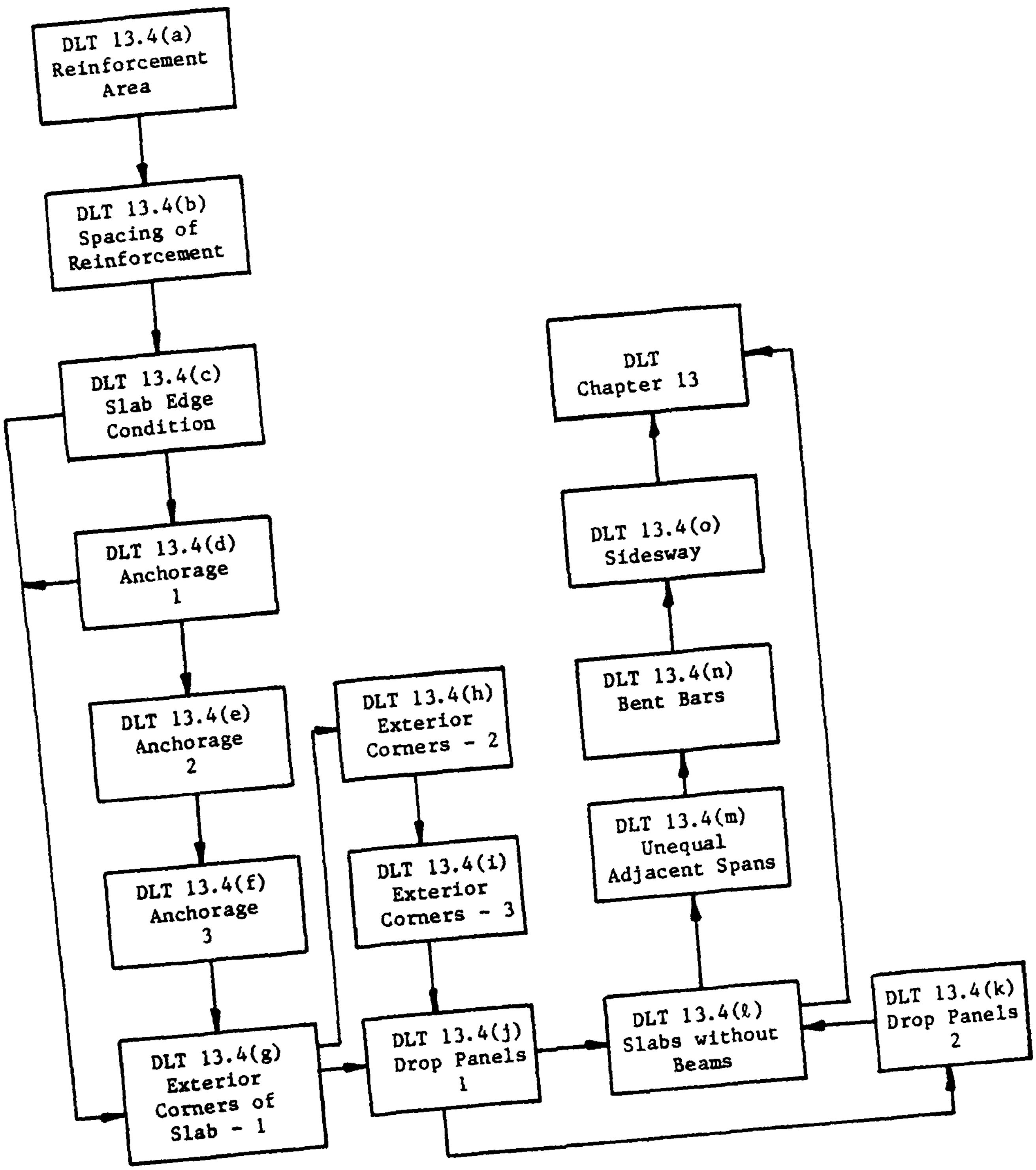
Comment: 1) DLT 13.3(g) covers Section 13.3.4.1.

Datum 13.3(h)	Source	Label	Number
If design for transfer of load from slab to supporting columns or walls through shear and torsion in accordance with Chapter 11.	X		

DLT 13.3(h) Transfer of Load		1	2
C1	Design for transfer of load from slab to supporting columns or walls through shear and torsion in accordance with Chapter 11?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT Chapter 13	X	X

Comment: 1) DLT 13.3(h) covers Section 13.3.5.

Section 13.4 Map



Section 13.4 Slab Reinforcement

Datum 13.4(a)	Source	Label	Number
If area of reinforcement in each direction for two-way slab systems determined from moments at critical sections.	X		
If area of reinforcement greater than or equal to that required for shrinkage and temperature in Section 7.12.	X		

DLT 13.4(a)	Reinforcement Area	1	2	3
C1	Area of reinforcement in each direction for two-way slab systems determined from moments at critical sections?	Y	Y	N
C2	Area of reinforcement greater than or equal to that required for shrinkage and temperature in Section 7.12?	Y	N	I
A1	Provision = satisfied	X		
A2	Provision ≠ satisfied		X	X
A3	DLT 13.4(b)	X	X	X

Comment: 1) DLT 13.4(a) covers Section 13.4.1.

Datum 13.4(b)	Source	Label	Number
Spacing of reinforcement at critical sections.	X	s	
Overall thickness of slab, in.	X	h	
If critical sections in portions of slab area of cellular or ribbed construction.	X		
If reinforcement in the slab over cellular spaces provided as required by Section 7.12.	X		

DLT 13.4(b)	Spacing of Reinforcement	1	2	3	4	
C1	Critical sections in portions of slab area of cellular or ribbed construction?	Y	Y	N	N	E
						L
C2	Reinforcement in the slab over cellular spaces provided as required by Section 7.12?	Y	N			S
						E
C3	$s \leq 2\ h$	I	I	Y	N	
A1	Provision = satisfied	X		X		
A2	Provision $\neq$ satisfied		X		X	
A3	DLT 13.4(c)	X	X	X	X	
A4	Logical Error					X

Comment: 1) DLT 13.4(b) covers Section 13.4.2.

Datum 13.4(c)	Source	Label	Number
If slab has a discontinuous edge.	X		

DLT 13.4(c) Slab Edge Condition		1	2
C1	Slab with discontinuous edge?	Y	N
A1	DLT 13.4(d)	X	
A2	DLT 13.4(g)		X

Comment: 1) DLT 13.4(c) determines the applicability of Sections 13.4.3, 13.4.4, and 13.4.5.

Datum 13.4(d)	Source	Label	Number
If the slab is supported by a spandrel beam or wall at a discontinuous edge.	X		
If the slab cantilevers beyond the support.	X		
If the reinforcement is anchored within the slab.	X		

DLT 13.4(d) Anchorage - 1		1	2	3	4	
C1	Slab not supported by a spandrel beam or wall at a discontinuous edge?	Y	N	N	N	E
						L
C2	Slab cantilevers beyond support?		Y	N	N	S
C3	Anchorage of reinforcement within the slab?	I	I	Y	N	E
A1	Provisions = satisfied	X	X		X	
A2	Provisions ≠ satisfied			X		
A3	Logical Error					X
A4	DLT 13.4(e)		X		X	
A5	DLT 13.4(g)	X				

Comments: 1) DLT 13.4(d) covers Section 13.4.5.

2) It is assumed here that wall edge support is either a spandrel beam or a wall. Therefore if C1 is Y, C2 is inapplicable.

3) A column is not mentioned as an edge support in Section 13.4.5, but columns as edge support is implied in Sections 13.4.3 and 13.4.4.

Datum 13.4(e)	Source	Label	Number
If positive moment reinforcement perpendicular to a discontinuous edge extends to the edge of the slab.	X		
If embedment, straight or hooked, $\geq$ 6" in spandrel beams, columns or walls.	X		

DLT 13.4(e) Anchorage - 2		1	2	3
C1	Positive moment reinforcement perpendicular to a discontinuous edge extends to the edge of the slab?	Y	Y	N
C2	Reinforcement embedment is straight or hooked, $\geq$ 6" in spandrel beams, columns, or walls?	Y	N	I
A1	Provision = satisfied	X		
A2	Provision $\neq$ satisfied		X	X
A3	DLT 13.4(f)	X	X	X

Comment: 1) DLT 13.4(e) covers Section 13.4.3.

Datum 13.4(f)	Source	Label	Number
If negative moment reinforcement perpendicular to a discontinuous edge bent, hooked, or otherwise anchored in spandrel beams, columns, or walls.	X		
If anchorage developed at face of the support according to the provisions of Chapter 12.	X		

DLT 13.4(f) Anchorage - 3		1	2	3
C1	Negative moment reinforcement perpendicular to a discontinuous edge bent, hooked, or otherwise anchored in spandrel beams, columns, or walls?	Y	Y	N
C2	Anchorage developed at face of support according to provisions of Chapter 12?	Y	N	I
A1	Provision = satisfied	X		
A2	Provision ≠ satisfied		X	X
A3	DLT 13.4(g)	X	X	X

Comment: 1) DLT 13.4(f) covers Section 13.4.4.

Datum 13.4(g)	Source	Label	Number
If slab has a beam (or beams) between supports.	X		
Ratio of flexural stiffness of columns above and below the slab to combined flexural stiffness of the slabs and beams at a joint taken in the direction of the span for which moments are being determined = $2\ K_c/(\Sigma K_s+K_b)$.	X	α	
If special top and bottom reinforcement is provided at exterior corners.	X		
Flexural stiffness of beam; moment per unit rotation.	X	K_b	
Flexural stiffness of column; moment per unit rotation.	X	K_c	
Flexural stiffness of slab; moment per unit rotation.	X	K_s	

DLT 13.4(g) Exterior Corner of Slab - 1		1	2	3	4	
C1	Slabs with beams between supports?	Y	Y	Y	N	E
C2	$\alpha > 1.0$?	Y	Y	N		L
C3	Special top and bottom reinforcement provided at exterior corners?	Y	N	I	I	S
						E
A1	Provision = satisfied	X		X		
A2	Provision ≠ satisfied		X			
A3	DLT 13.4(h)	X				
A4	DLT 13.4(j)		X	X	X	
A5	Logical Error					X

Comment: 1) DLT 13.4(g) covers Section 13.4.6.

Datum 13.4(h)	Source	Label	Number
If the special reinforcement at exterior corners in both top and bottom of slab sufficient to resist a moment equal to the maximum positive moment (per foot of width) in the slab.	X		
If direction of moment assumed parallel to the diagonal from the corner in the top of the slab and perpendicular to the diagonal in the bottom of the slab.	X		

DLT 13.4(h) Exterior Corners - 2		1	2	3
C1	Special reinforcement at exterior corners in both top and bottom of slab sufficient to resist a moment equal to the maximum positive moment (per foot of width) in the slab?	Y	Y	N
C2	Direction of moment assumed parallel to the diagonal from the corner in the top of the slab and perpendicular to the diagonal in the bottom of the slab?	Y	N	I
A1	Provision = satisfied	X		
A2	Provision ≠ satisfied		X	X
A3	DLT 13.4(i)	X	X	X

Comment: 1) DLT 13.4(h) covers Sections 13.4.6.1 and 13.4.6.2.

Datum 13.4(i)	Source	Label	Number
If the special reinforcement provided for a distance in each direction from the corner equal to 1/5 the longer span.	X		
If the special reinforcement in either the top or bottom of the slab placed in a single band in the direction of the moment or in two bands parallel to the sides of the slab.	X		

DLT 13.4(i)	Exterior Corners - 3	1	2
C1	The special reinforcement provided for a distance in each direction from the corner equal to 1/5 the longer span?	Y	N
C2	The special reinforcement in either the top or bottom of the slab placed in a single band in the direction of the moment or in two bands parallel to the sides of the slab?	I	I
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT 13.4(j)	X	X

Comment: 1) DLT 13.4(i) covers Sections 13.4.6.3 and 13.4.6.4.

Datum 13.4(j)	Source	Label	Number
If drop panel used to reduce amount of negative moment reinforcement over the column of a flat slab.	X		
If drop panel extends in each direction from center line of support a distance not less than 1/6 the span length measured from center-to-center of supports in that direction.	X		

DLT 13.4(j) Drop Panels - 1		1	2	3	
C1	Drop panels used to reduce amount of negative moment reinforcement over the column of a flat slab?	Y	Y	N	E L
C2	Drop panel extends in each direction from center line of support a distance not less than 1/6 the span length measured from center-to-center of supports in that direction?	Y	N		S E
A1	Provision = satisfied	X			
A2	Provision ≠ satisfied		X		
A3	DLT 13.4(k)	X	X		
A4	DLT 13.4(ℓ)			X	
A5	Logical Error				X

Comment: 1) DLT 13.4(j) covers Sections 13.4.7 and 13.4.7.1.

Datum 13.4(k)	Source	Label	Number
If projection of drop panel below the slab at least 1/4 the slab thickness beyond the drop.	X		
If thickness of drop panel below slab, in computing required slab reinforcement, assumed greater than 1/4 the distance from edge of drop panel to edge of column or column capital.	X		

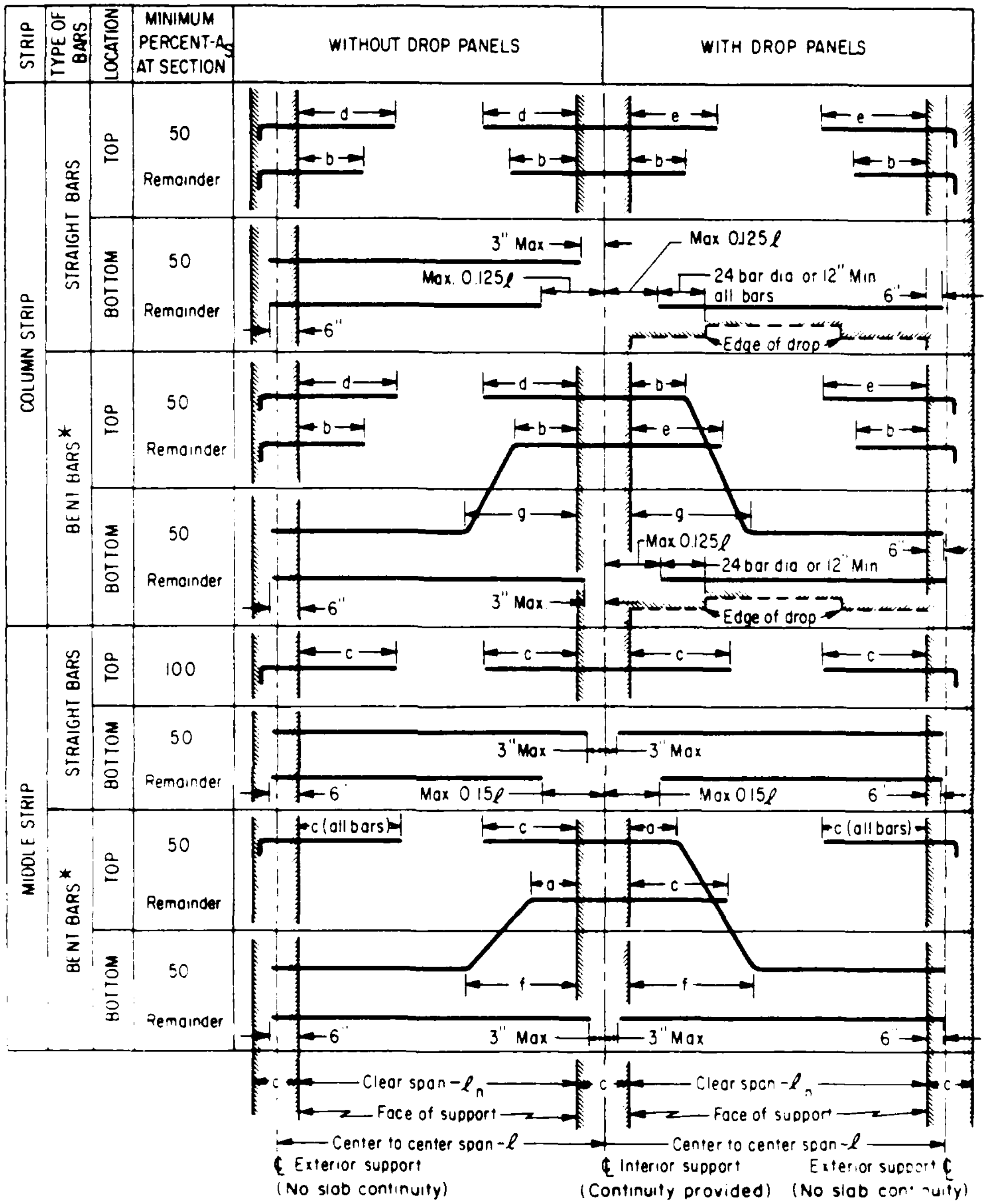
DLT 13.4(k) Drop Panel - 2		1	2	3
C1	Projection of drop panel below the slab at least 1/4 the slab thickness beyond the drop?	Y	Y	N
C2	Thickness of the drop panel below the slab used in computing required slab reinforcement assumed greater than 1/4 the distance from edge of drop panel to edge of column or capital?	Y	N	I
A1	Provisions = satisfied		X	
A2	Provisions ≠ satisfied	X		X
A3	DLT 13.4(ℓ)	X	X	X

Comment: 1) DLT 13.4(k) covers Sections 13.4.7.2 and 13.4.7.3.

Datum 13.4(ℓ)	Source	Label	Number
If slabs without beams.	X		
If reinforcement has minimum bend point locations and extensions for reinforcement as prescribed in Fig. 13.4.8.	X		

DLT 13.4(ℓ) Slabs Without Beams		1	2	3
C1	Slab without beams?	Y	Y	N
C2	Reinforcement has minimum bend point locations and extensions for reinforcement as prescribed in Fig. 13.4.8?	Y	N	I
A1	Provision = satisfied	X		
A2	Provision ≠ satisfied		X	
A3	DLT 13.4(m)	X	X	
A4	DLT Ch. 13			X

Comment: 1) DLT 13.4(ℓ) covers Section 13.4.8.1.



* Bent bars at exterior supports may be used if a general analysis is made

	BAR LENGTH FROM FACE OF SUPPORT						
	MINIMUM LENGTH					MAXIMUM LENGTH	
MARK	a	b	c	d	e	f	g
LENGTH	0.14 ℓ_n	0.20 ℓ_n	0.22 ℓ_n	0.30 ℓ_n	0.33 ℓ_n	0.2[illegible] ℓ_n	0.24 ℓ_n

Fig. 13.4.8 — Minimum bend point locations and extensions for reinforcement in slabs without beams (See Section 12.12.1 for reinforcement extension into supports)

Datum 13.4(m)	Source	Label	Number
If adjacent spans are unequal.	X		
If extension of negative reinforcement beyond the face of support as prescribed in Fig. 13.4.8 based on requirements of longer span.	X		

DLT 13.4(m) Unequal Adjacent Spans		1	2	3
C1	Adjacent spans unequal?	Y	Y	N
C2	Extension of negative reinforcement beyond the face of support as prescribed in Fig. 13.4.8 based on requirements of longer span?	Y	N	I
A1	Provision = satisfied	X		
A2	Provision ≠ satisfied		X	
A3	DLT 13.4(n)	X	X	X

Comment: 1) DLT 13.4(m) covers Section 13.4.8.2.

Datum 13.4(n)	Source	Label	Number
If bent bars used.	X		
If depth-span ratio permits use of bends of 45 degrees or less.	X		

DLT 13.4(n)	Bent Bars	1	2	3
C1	Bent bars used?	Y	Y	N
C2	Depth-span ratio permits use of bends of 45 degrees or less?	Y	N	I
A1	Provision = satisfied	X		
A2	Provision ≠ satisfied		X	
A3	DLT 13.4(o)	X	X	X

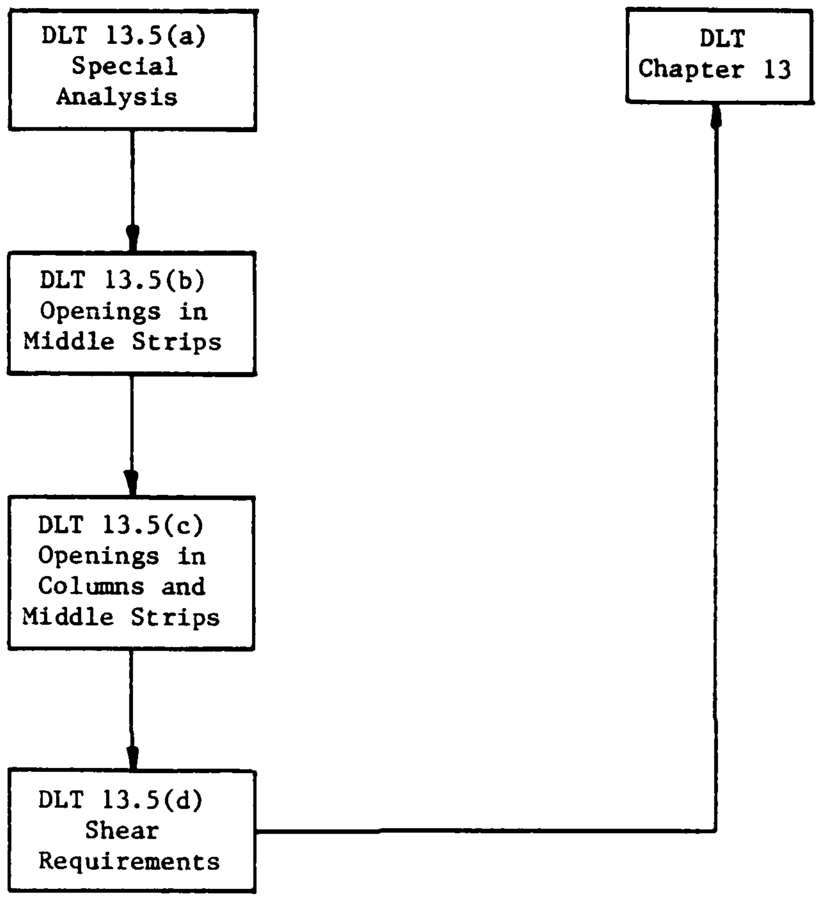
Comment: 1) DLT 13.4(n) covers Section 13.4.8.3.

Datum 13.4(o)	Source	Label	Number
If slabs in frames not braced against sidesway or slabs resisting lateral loads.	X		
If lengths of reinforcement determined by analysis.	X		
If lengths of reinforcement less than those prescribed in Fig. 13.4.8.	X		

DLT 13.4(o) Sidesway		1	2	3	4
C1	Slabs in frames not braced against sidesway or slabs resisting lateral loads?	Y	Y	Y	N
C2	Lengths of reinforcement determined by analysis?	Y	Y	N	I
C3	Lengths of reinforcement less than those prescribed in Fig. 13.4.8?	Y	N	I	I
A1	Provision = satisfied		X		
A2	Provision ≠ satisfied	X		X	
A3	DLT Ch. 13	X	X	X	X

Comment: 1) DLT 13.4(o) covers Section 13.4.8.4.

Section 13.5 Map



Section 13.5 Openings in Slabs

Datum 13.5(a)	Source	Label	Number
If opening in slab.	X		
If shown by analysis that the design strength is at least equal to the required strength considering Sections 9.2 and 9.3.	X		
If shown by analysis that all serviceability conditions, including specified limits on deflections are met.	X		

DLT 13.5(a)	Special Analyses	1	2	3	4	
C1	Opening in slab?	Y	Y	Y	N	E
C2	Shown by analysis that the design strength is at least equal to the required strength considering Sections 9.2 and 9.3?	Y	Y	N		L S
C3	Shown by analysis that all serviceability conditions, including limits on deflections are met?	Y	N	I		E
A1	Provision = satisfied	X				
A2	Provision ≠ satisfied		X	X		
A3	DLT 13.5(b)		X	X		
A4	DLT Ch. 13	X			X	
A5	Logical Error					X

Comment: 1) DLT 13.5(a) covers Section 13.5.1.

Datum 13.5(b)	Source	Label	Number
If opening in area common to intersecting middle strips.	X		
If total amount of reinforcement required for the panel without the opening is maintained.	X		
Interruption (dimension) of column strip by opening in each span.	X		
Width of column in each span.	WCS		
If an amount of reinforcement equivalent to that interrupted by the opening is added on the sides of the opening.	X		

DLT 13.5(b)	Openings in Middle Strips	1	2	3	4	5	
C1	Opening in area common to intersecting middle strips?	Y	Y	Y	Y	N	ELSE
C2	Total amount of reinforcement required for the panel without the opening maintained?	Y	Y	Y	N		
C3	Interruption of column strip by opening $\leq$ 1/8 WCS in either span?	Y	Y	N	Y		
C4	Amount of reinforcement equivalent to that interrupted by the opening added on the sides of the opening?	Y	N	I	I		
A1	Provision = satisfied	X					
A2	Provision $\neq$ satisfied		X	X	X		
A3	DLT 13.5(c)	X	X	X	X	X	
A4	Logical Error						X

Comment: 1) DLT 13.5(b) covers Section 13.5.2.

Datum 13.5(c)	Source	Label	Number
If opening in area common to one middle strip and one column strip.	X		
If more than 1/4 the reinforcement in either strip interrupted by openings.	X		
If amount of reinforcement equivalent to that interrupted by opening added on the sides of opening.	X		

DLT 13.5(c) Openings in Column and Middle Strips		1	2	3	4	
C1	Opening in area common to one middle strip and one column strip?	Y	Y	Y	N	E
C2	More than 1/4 the reinforcement in either strip interrupted by openings?	Y	N	N		L S
C3	Amount of reinforcement equivalent to that interrupted by opening added on the sides of the opening?	I	Y	N		E
A1	Provision = satisfied		X			
A2	Provision ≠ satisfied	X		X		
A3	DLT 13.5(d)	X	X	X	X	
A4	Logical Error					X

Comment: 1) DLT 13.5(c) covers Section 13.5.2.3.

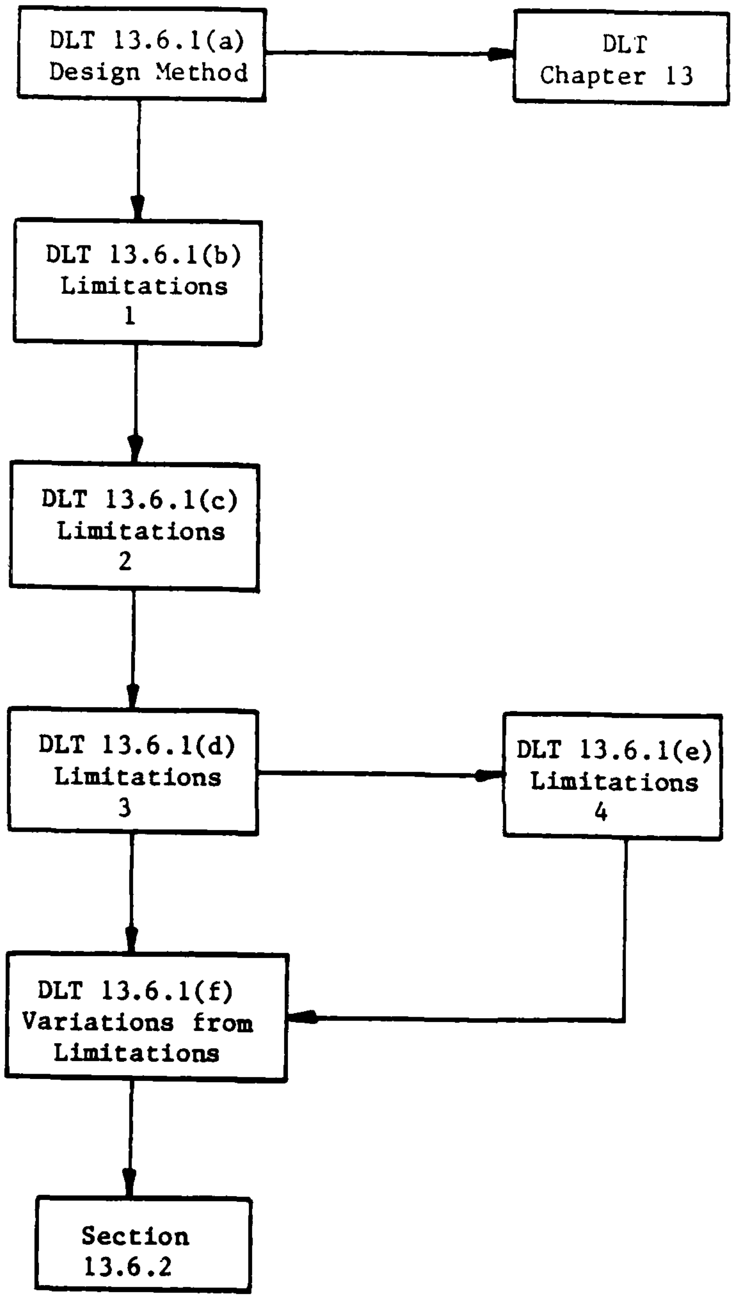
Datum 13.5(d)	Source	Label	Number
If shear requirements of Section 11.11.5 satisfied.	X		

DLT 13.5(d) Shear Requirements		1	2
C1	Shear requirements of Section 11.11.5 satisfied?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT Ch. 13	X	X

Comments: 1) DLT 13.5(d) covers Section 13.5.2.4.

2) This Section is primarily a reminder.

Section 13.6.1 Map



Section 13.6 Direct Design Method

Datum 13.6.1(a)	Source	Label	Number
If slab system designed using Direct Design Method.	X		

DLT 13.6.1(a) Design Method		1	2
C1	Slab system designed using Direct Design Method.	Y	N
A1	DLT 13.6.1(b)	X	
A2	DLT Ch. 13		X

Comment: 1) DLT 13.6.1(a) is a switching DLT that partially covers Section 13.6.1.

Datum 13.6.1(b)	Source	Label	Number
If a minimum of three continuous spans in each direction.	X		
If panels rectangular with a ratio of longer to shorter span within a panel $\leq$ 2.	X		
If successive span lengths in each direction differ by more than 1/3 the longer span.	X		

DLT 13.6.1(b) Limitations - 1		1	2	3	4
C1	A minimum of three continuous spans in each direction?	Y	Y	Y	N
C2	Panels rectangular with a ratio of longer to shorter span within a panel $\leq$ 2?	Y	Y	N	I
C3	Successive span lengths in each direction differ by more than 1/3 the longer span?	Y	N	I	I
A1	Provisions = satisfied		X		
A2	Provisions $\neq$ satisfied	X		X	X
A3	DLT 13.6.1(c)	X	X	X	X

Comment: 1) DLT 13.6.1(b) covers Sections 13.6.1.1, 13.6.1.2 and 13.6.1.3.

Datum 13.6.1(c)	Source	Label	Number
If column offset ≤ 10% of the span (in direction of offset) from either axis between center lines of successive columns.	X		
If all loads due to gravity only and uniformly distributed over entire panel.	X		
If live load exceeds 3 times dead load.	X		

DLT 13.6.1(c) Limitations - 2		1	2	3	4
C1	Column offset ≤ 10% of the span (in direction of offset) from either axis between center lines of successive columns?	Y	Y	Y	N
C2	All loads due to gravity only and uniformly distributed over entire panel?	Y	Y	N	I
C3	Live load exceeds 3 times dead load?	Y	N	I	I
A1	Provision = satisfied		X		
A2	Provision ≠ satisfied	X		X	X
A3	DLT 13.6.1(d)	X	X	X	X

Comment: 1) DLT 13.6.1(c) covers Sections 13.6.1.4 and 13.6.1.5.

Datum 13.6.1(d)	Source	Label	Number
If moment redistribution as permitted by Section 8.4 applied for slab system.	X		
If panel with beams between supports on all sides.	X		
Length of span in direction that moments are being determined, measured center-to-center of supports.	X	ℓ_1	
Length of span transverse to ℓ_1, measured center-to-center of supports.	X	ℓ_2	
α in direction of ℓ_1.	X	α_1	
α in direction of ℓ_2.	X	α_2	

DLT 13.6.1(d) Limitations - 3		1	2	3	4
C1	Moment redistribution as permitted in Section 8.4 applied to slab system?	Y	Y	N	N
C2	Panel with beams between supports on all sides?	Y	N	Y	N
A1	Provisions = satisfied			X	X
A2	Provisions ≠ satisfied, see Section 13.6.7	X	X		
A3	$S_t = \dfrac{\alpha_1 \ell_2^2}{\alpha_2 \ell_1^2}$	X		X	
A4	DLT 13.6.1(e)	X		X	
A5	DLT 13.6.1(f)		X		X

Comment: 1) DLT 13.6.1(d) covers Section 13.6.1.7 and partially 13.6.1.6.

Datum 13.6.1(e)	Source	Label	Number
Relative stiffness of beams in two perpendicular directions.	DLT 13.6(d)	S_t	

DLT 13.6.1(e) Limitations - 4		1	2
C1	$5.0 \geq S_t \geq 0.2$?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT 13.6.1(f)	X	X

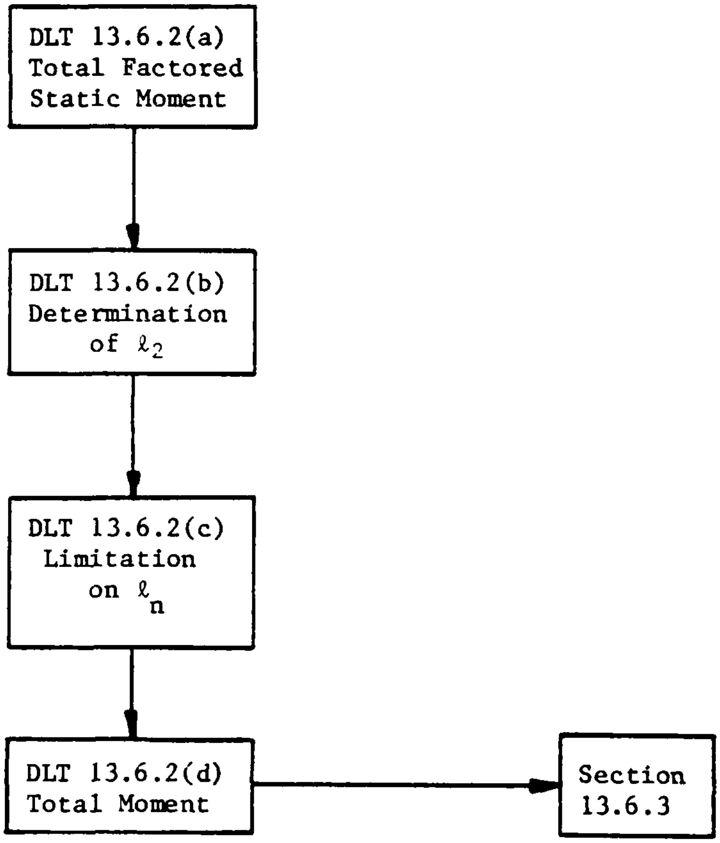
Comment: 1) DLT 13.6.1(e) covers Section 13.6.1.6.

Datum 13.6.1(f)	Source	Label	Number
If variations from the limitations of Section 13.6.1 exist.	X		
If demonstrated by analysis that requirements of Section 13.3.1 are satisfied.	X		

DLT 13.6.1(f)	Variations from Limitations	1	2	3
C1	Variations from limitations of Section 13.6.1 exist?	Y	Y	N
C2	Demonstrated by analysis that the requirements of Section 13.3.1 are satisfied?	Y	N	I
A1	Provision = satisfied	X		
A2	Provision ≠ satisfied		X	
A3	DLT 13.6.2(a)	X	X	X

Comment: 1) DLT 13.6.1(f) covers Section 13.6.1.8.

Section 13.6.2 Map



Section 13.6.2 Total Factored Static Moment for a Span

Datum 13.6.2(a)	Source	Label	Number
If total factored static moment for a span determined in a strip bounded laterally by center line of panel on each side of center line of supports.	X		

DLT 13.6.2(a)	Total Factored Static Moment	1	2
C1	Total factored static moment for a span determined in a strip bounded laterally by center line of panel on each side of center line of supports?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT 13.6.2(b)	X	X

Comment: 1) DLT 13.6.2(a) covers Section 13.6.2.1.

Datum 13.6.2(b)	Source	Label	Number
If transverse span of panels on either side of the center line of supports varies.	X		
Average of adjacent transverse span.	X	$\hat{\ell}_2$	
If span adjacent and parallel to an edge is being considered.	X		
Distance from edge to panel center line.	X	$\bar{\ell}_2$	
Length of span transverse to ℓ_1, measured center-to-center of supports.	X	ℓ_2	

DLT 13.6.2(b)	Determination of ℓ_2	1	2	3	
C1	Transverse span of panels on either side of the center line of support varies?	Y	N	N	ELSE
C2	Span adjacent and parallel to an edge is being considered?	N	Y	N	
A1	$\ell_2 = \hat{\ell}_2$	X			
A2	$\ell_2 = \bar{\ell}_2$		X		
A3	$\ell_2 = \ell_2$			X	
A4	DLT 13.6.2(c)	X	X	X	
A5	Logical Error				X

Comment: 1) DLT 13.6.2(b) covers Sections 13.6.2.3 and 13.6.2.4.

Datum 13.6.2(c)	Source	Label	Number
If clear span ℓ_n extends from face-to-face of columns, capitals, brackets, or walls.	X		
Length of clear span in direction that moments are being determined, measured face-to-face of supports, e.g., columns, capitals, brackets, and walls.	X	ℓ_n	
Length of span in direction that moments are being determined, measured center-to-center of supports.	X	ℓ_1	

DLT 13.6.2(c) Limitation on ℓ_n		1	2
C1	$\ell_n \geq 0.65\ \ell_1$?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT 13.6.2(d)	X	X

Comments:

1) DLT 13.6.2(c) covers Section 13.6.2.5.

2) Circular or regular polygon shaped supports are treated as square supports with the same area.

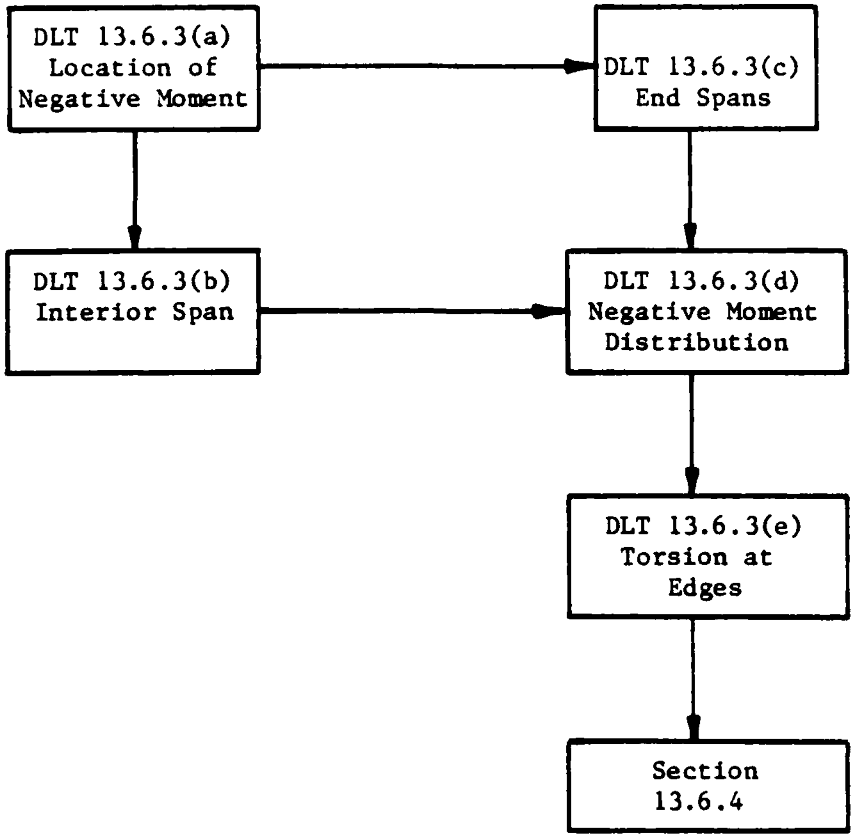
Datum 13.6.2(d)	Source	Label	Number
Absolute sum of positive and average negative factored moments in each direction.	X	M_o	
Factored load per unit area.	X	W_u	
Length of clear span in direction that moments are being considered measured face-to-face of supports, e.g., columns, capitals, brackets, and walls.	X	ℓ_n	
Length of span transverse to ℓ_1.	DLT 13.6.2(b)	ℓ_2	

DLT 13.6.2(d) Total Moment		1	2
C1	$M_o \geq \frac{W_u \ell_2 \ell_n^2}{8}$?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT 13.6.3(a)	X	X

Comment:

1) DLT 13.6.2(d) covers Section 13.6.2.2.

Section 13.6.3 Map



Section 13.6.3 Negative and Positive Factored Moments

Datum 13.6.3(a)	Source	Label	Number
If circular or regular polygon shaped supports treated as square supports with the same area.	X		
If negative factored moments located at face of supports.	X		
If interior span.	X		

DLT 13.6.3(a)	Location of Negative Moment	1	2	3	4
C1*	Negative factored moments located at face of supports?	Y	Y	N	N
C2	Interior span?	Y	N	Y	N
A1	Provisions = satisfied	X	X		
A2	Provisions ≠ satisfied			X	X
A3	DLT 13.6.3(b)	X		X	
A4	DLT 13.6.3(c)		X		X

Comment:

1) DLT 13.6.3(a) covers Section 13.6.3.1.

* Circular or regular polygon-shaped supports shall be treated as square supports with the same area.

Datum 13.6.3(b)	Source	Label	Number
Design total factored static moment.	X	M_o	
Design negative factored moment.	X	M_n	
Design positive factored moment.	X	M_p	

DLT 13.6.3(b) Interior Span		1	2	3
C1	$M_n = 0.65\ M_o$?	Y	Y	N
C2	$M_p = 0.35\ M_o$?	Y	N	I
A1	Provision = satisfied	X		
A2	Provision ≠ satisfied		X	X
A3	DLT 13.6.3(d)	X	X	X

Comment: 1) DLT 13.6.3(b) covers Section 13.6.3.2.

Datum 13.6.3(c)	Source	Label	Number
Design total factored static moment.	X	M_o	
Design interior negative factored moment.	X	M_{in}	
Design positive factored moment.	X	M_p	
Design exterior negative factored moment.	X	M_{en}	
Ratio of flexural stiffness of equivalent column to combined flexural stiffness of the slabs and beams at a joint taken in the direction of the span for which moments are being determined = $K_{ec}/\Sigma(K_s+K_b)$, where K_{ec} is computed in accordance with Section 13.7.4 for the exterior column.	X	α_{ec}	

DLT 13.6.3(c) End Spans		1	2	3	4
C1	$M_{in} = \left(0.75 - \frac{0.10}{1 + 1/\alpha_{ec}}\right) M_o$?	Y	Y	Y	N
C2	$M_p = \left(0.63 - \frac{0.28}{1 + 1/\alpha_{ec}}\right) M_o$?	Y	Y	N	I
C3	$M_{en} = \left(\frac{0.65}{1 + 1/\alpha_{ec}}\right) M_o$?	Y	N	I	I
A1	Provision = satisfied	X			
A2	Provision ≠ satisfied		X	X	X
A3	DLT 13.6.3(d)	X	X	X	X

Comment: 1) DLT 13.6.3(c) covers Section 13.6.3.3.

2) The phrase at the end of 13.6.3.2 "...where α_{ec} is computed in accordance with Section 13.7.4 for the exterior column" is confusing. One could infer that some other procedure applies to interior columns.

Datum 13.6.3(d)	Source	Label	Number
If the negative moment sections designed to resist the larger of the two interior negative factored moments determined for spans framing into a common support.	X		
If analysis is made to distribute the unbalanced moment in accordance with stiffnesses of adjoining elements.	X		

DLT 13.6.3(d)	Negative Moment Distribution	1	2	3
C1	Negative moment sections designed to resist the larger of the two interior negative factored moments determined for spans framing into a common support?	Y	N	N
C2	Analysis made to distribute the unbalanced moment in accordance with stiffnesses of adjoining elements?	I	Y	N
A1	Provision = satisfied	X	X	
A2	Provision ≠ satisfied			X
A3	DLT 13.6.3(e)	X	X	X

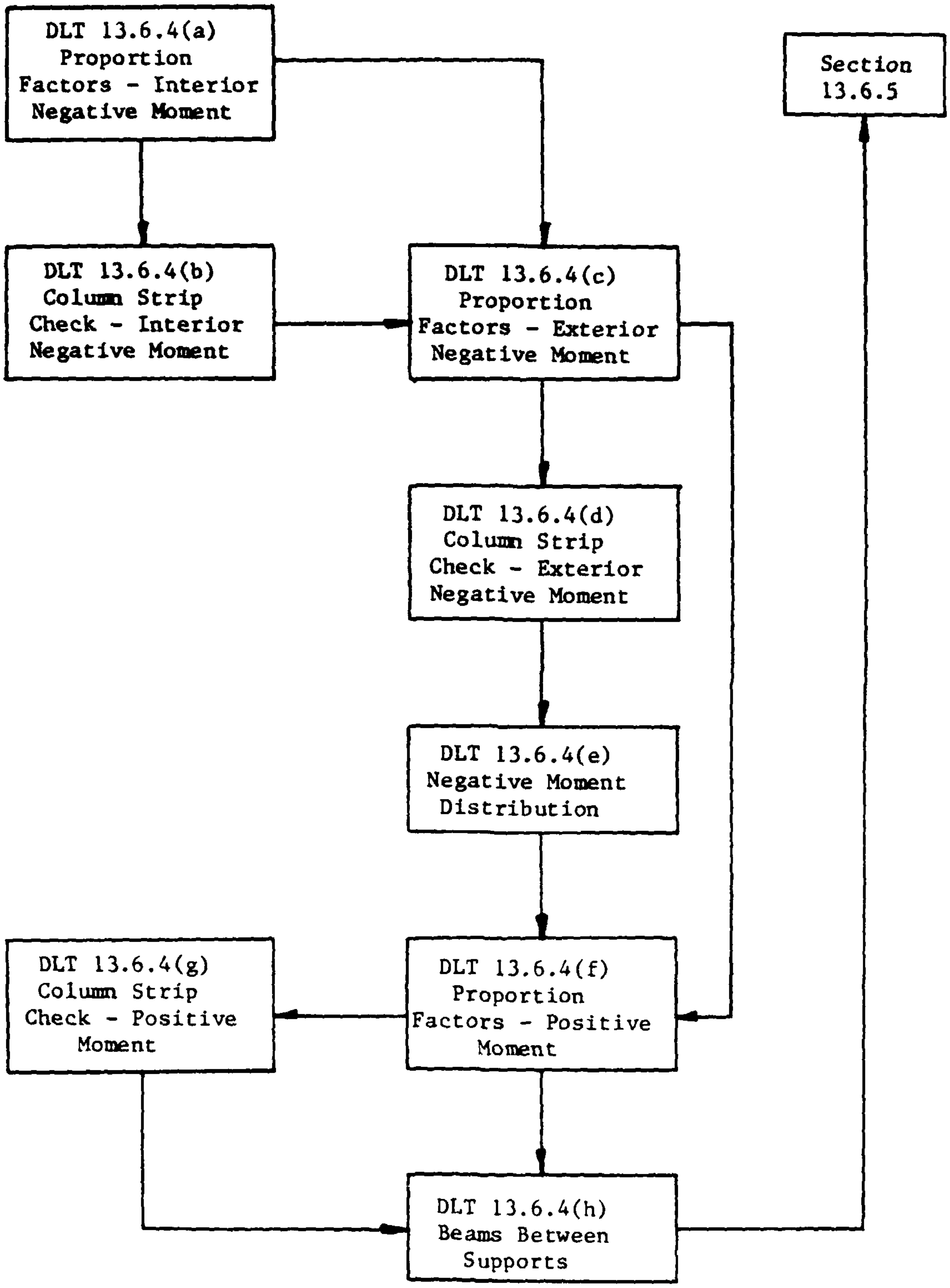
Comment: 1) DLT 13.6.3(d) covers Section 13.6.3.4.

Datum 13.6.3(e)	Source	Label	Number
If edge beams or edges of slab proportioned to resist in torsion their share of exterior negative factored moments.	X		

DLT 13.6.3(e) Torsion at Edges		1	2
C1	Edge beams and edges of slab proportioned to resist in torsion their share of exterior negative factored moments?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT 13.6.4(a)	X	X

Comment: 1) DLT 13.6.3(e) covers Section 13.6.3.5.

Section 13.6.4 Map



Section 13.6.4 Factored Moments in Column Strips

Datum 13.6.4(a)	Source	Label	Number
If checking the interior negative moments for column strip design.	X		
Ratio of flexural stiffness of beam section to flexural stiffness of a width of slab bounded laterally by center lines of adjacent panels (if any) on each side of the beam in the direction moments are being determined = $E_{cb}I_s/E_{cs}I_s$.	X	α_1	
Length of span in direction moments are being determined measured center-to-center of supports.	X	ℓ_1	
Length of span transverse to ℓ_1, measured center-to-center of supports.	X	ℓ_2	

DLT 13.6.4(a)	Proportion Factors - Interior Negative Moment	1	2
C1	Checking interior negative factored moments for column strip design?	Y	N
A1	$P_{1+} = 90 - 30\left[\frac{\ell_2}{\ell_1} - 0.5\right],\ 0.5 \le \frac{\ell_2}{\ell_1} \le 2.0$	X	
A2*	$P_{in} = P_{1+} - \left[P_{1+} - 75\right]\left[1 - \frac{\alpha_1 \ell_2}{\ell_1}\right]$	X	
A3	DLT 13.6.4(b)	X	
A4	DLT 13.6.5(c)		X

Comment:

1) DLT 13.6.4(a) partially covers Section 13.6.4.1.

* If $\frac{\alpha_1 \ell_2}{\ell_1} > 0$, set $\frac{\alpha_1 \ell_2}{\ell_1} = 1$.

Datum 13.6.4(b)	Source	Label	Number
Amount if interior negative factored moment used to design column strip.	X	$CSM_{in.}$	
Design interior negative factored moment.	X	$M_{in.}$	
Proportion of moment, column strip.	DLT 13.6.4(a)	$P_{in.}$	

DLT 13.6.4(b)	Column Strip Check - Internal Negative Moment	1	2
C1	$CSM_{in} = P_{in.}M_{in.}$?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT 13.6.4(c)	X	X

Comment: 1) DLT 13.6.4(b) covers Section 13.6.4.1.

Datum 13.6.4(c)	Source	Label	Number
If checking exterior negative moment for column strip design.	X		
Ratio of flexural stiffness of beam section to flexural stiffness of a width of slab bounded laterally by center lines of adjacent panels (if any) on each side of the beam in the direction of ℓ_1.	X	α_1	
Length of span in direction that moments are being determined, measured center-to-center of supports.	X	ℓ_1	
Length of span transverse to ℓ_1, measured center-to-center of supports. See also Sections 13.6.2.3 and 13.6.2.4.	X	ℓ_2	
Ratio of torsional stiffness of edge beam section to flexural stiffness of a width of slab equal to span length of beam, center-to-center of supports.	X	β_t	

(Continued)

DLT 13.6.4(c)	Proportion Factors - Exterior Negative Moment	1	2	3	4	
C1	Checking exterior negative factored moment for column strip design?	Y	Y	Y	N	E L S E
C2*	$\alpha_1 \ell_2/\ell_1 = 0$?	Y	N	N	I	
C3	$\alpha_1 \ell_2/\ell_1 \geq 1$?	N	Y	N	I	
A1**	$P_{en0} = 75 + 25 \left[(2.5-\beta_t)/2.5\right]$	X		X		
A2	$P_{en2.5+} = 90 - 30 \left[\frac{\ell_2}{\ell_1} - 0.5\right],\ 0.5 \leq \frac{\ell_2}{\ell_1} \leq 2.0$		X	X		
A3**	$\overline{P}_{en1} = P_{en2.5+} - \left[P_{en2.5+} - 100\right]\left[\frac{2.5-\beta_t}{2.5}\right]$		X	X		
A4	$P_{en} = \overline{P}_{en1}$		X			
A5	$P_{en} = P_{en0}$	X				
A6	$P_{en} = P_{en0} + (\overline{P}_{en1} - P_{en0})\left(\frac{\alpha_1 \ell_2}{\ell_1}\right)$			X		
A7	DLT 13.6.4(d)	X	X	X		
A8	DLT 13.6.4(f)				X	
A9	Logical Error					X

Comment:

1) DLT 13.6.4(c) partially covers Section 13.6.4.2.

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* $\alpha_1 = E_{cb} I_b / E_{cs} I_s$.

** If $\beta_t = \frac{E_{cb} C}{2 E_{cs} I_s} > 2.5$, set $\beta_t = 2.5$.

Datum 13.6.4(d)	Source	Label	Number
Amount of exterior negative factored moments used to design column strips.	X	CSM_{en}	
Exterior negative factored moment.	X	M_{en}	
Proportion of moment.	DLT 13.6.4(c)	P_{en}	

DLT 13.6.4(d)	Column Strip Check - External Negative Moment	1	2
C1	$CSM_{en} = P_{en}M_{en}$?	Y	N
A1	Provision = satisfied	X	
A2	Provision $\neq$ satisfied		X
A3	DLT 13.6.4(e)	X	X

Comment: 1) DLT 13.6.4(d) covers Section 13.6.4.2.

Datum 13.6.4(e)	Source	Label	Number
If supports consist of columns or walls extending for a distance $\geq$ 3/4 the span length ℓ_2 used to compute M_o.	X		
If negative moments considered to be uniformly distributed across ℓ_2.	X		

DLT 13.6.4(e) Negative Moment Distribution		1	2	3
C1	Supports consist of columns or walls extending for a distance $\geq$ 3/4 the span length ℓ_2 used to compute M_o?	Y	Y	N
C2	Negative moments considered to be uniformly distributed across ℓ_2?	Y	N	I
A1	Provision = satisfied	X		
A2	Provision $\neq$ satisfied		X	
A3	DLT 13.6.4(f)	X	X	X

Comment: 1) DLT 13.6.4(e) covers Section 13.6.4.3.

Datum 13.6.4(f)	Source	Label	Number
If checking positive factored moments for column strip design.	X		
Ratio of flexural stiffness of beam section to flexural stiffness of a width of slab bounded laterally by center lines of adjacent panels (if any) on each side of the beam in the direction of ℓ_1.	X	α_1*	
Length of span in direction that moments are being determined, measured center-to-center of supports.	X	ℓ_1	
Length of span transverse to ℓ_1, measured center-to-center of supports. See also Sections 13.6.2.3 and 13.6.2.4.	X	ℓ_2	

DLT 13.6.4(f)	Proportion Factors - Positive Moment	1	2
C1	Checking positive factored moments for column strip design?	Y	N
A1	$P_{1+} = 90 - 30\left[\frac{\ell_2}{\ell_1} - 0.5\right],\ 0.5 \le \frac{\ell_2}{\ell_1} \le 2.0$	X	
A2*	$P_p = P_{1+} - \left[P_{1+} - 60\right]\left[1 - \frac{\alpha_1 \ell_2}{\ell_1}\right]$	X	
A3	DLT 13.6.4(g)	X	
A4	DLT 13.6.4(h)		X

Comment:

1) DLT 13.6.4(f) partially covers Section 13.6.4.4.

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* $\alpha_1 = E_{cb}I_b/E_{cs}I_s$.

Datum 13.6.4(g)	Source	Label	Number
Amount of positive factored moment used to design column strip.	X	CSM_p	
Positive factored moment.	X	M_p	
Proportion of moment	DLT 13.6.4(f)	P_p	

DLT 13.6.4(g)	Column Strip Check - Positive Moment	1	2
C1	$CSM_p = P_p M_p$?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT 13.6.4(h)	X	X

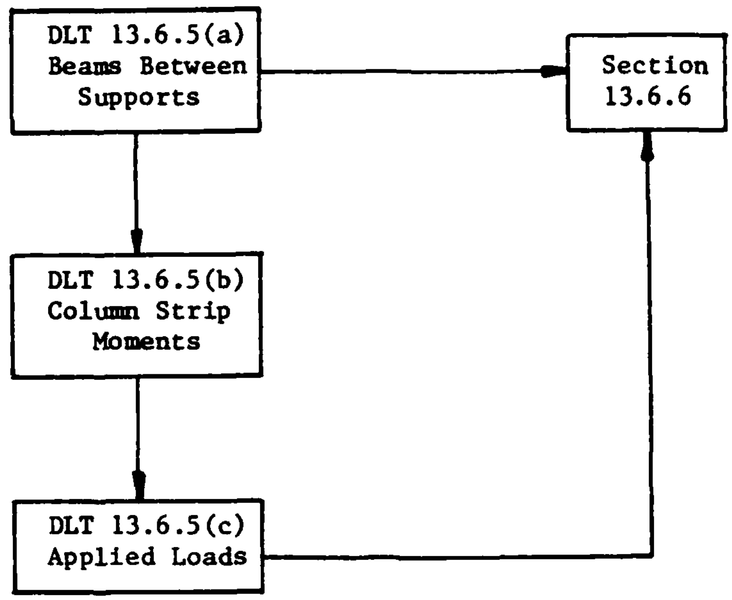
Comment: 1) DLT 13.6.4(g) partially covers Section 13.6.4.4.

Datum 13.6.4(h)	Source	Label	Number
If slabs with beams between supports.	X		
If slab portion of column strips proportioned to resist that portion of column strip moments not resisted by beams.	X		

DLT 13.6.4(h)	Beams Between Supports	1	2	3
C1	Slabs with beams between supports?	Y	Y	N
C2	Slab portion of column strips proportioned to resist that portion of column strip moments not resisted by beams?	Y	N	I
A1	Provision = satisfied	X		
A2	Provision ≠ satisfied		X	
A3	DLT 13.6.5(a)	X	X	X

Comment: 1) DLT 13.6.4(h) covers Section 13.6.4.5.

Section 13.6.5 Map



Section 13.6.5 Factored Moments in Beams

Datum 13.6.5(a)	Source	Label	Number
Length of span in direction moments are being determined measured center-to-center of supports.	X	ℓ_1	
Length of span transverse to ℓ_1, measured center-to-center of supports.	X	ℓ_2	
Ratio of flexural stiffness of beam to flexural stiffness of slab bounded laterally by center lines of adjacent panels (if any) on each side of the beam in the direction moments are being determined.	X	α_1	
If beams between supports proportioned to resist 85% of column strip moments.	X		

DLT 13.6.5(a) Beams Between Supports		1	2	3	4
C1	Beams between supports?	Y	Y	Y	N
C2	$\alpha_1\ell_2/\ell_1 \geq 1.0$?	Y	Y	N	I
C3	Beams between supports proportioned to resist 85% of column strip moment?	Y	N	I	I
A1	Provision = satisfied	X		X	
A2	Provision ≠ satisfied		X		
A3	DLT 13.6.5(b)	X	X	X	
A4	DLT 13.6.6(a)				X

Comment: 1) DLT 13.6.5(a) covers Section 13.6.5.1.

Datum 13.6.5(b)	Source	Label	Number
Length of span in direction of moments are being determined measured center-to-center of supports.	X	ℓ_1	
Length of span transverse to ℓ_1, measured center-to-center of supports.	X	ℓ_2	
Ratio of flexural stiffness of beam to flexural stiffness of slab bounded laterally by center lines of adjacent panels (if any) on each side of the beam in the direction moments are being determined.	X	α_1	
Portion of column strip moments resisted by beams.	X		

DLT 13.6.5(b) Column Strip Moments		1	2	3
C1	$0 < \alpha_1 \ell_2/\ell_1 < 1.0$?	Y	Y	N
C2	Portion of column strip moments resisted by beams = $[\alpha_1 \ell_2/\ell_1][0.85]$?	Y	N	I
A1	Provision - satisfied	X		
A2	Provision ≠ satisfied		X	
A3	DLT 13.6.5(c)	X	X	X

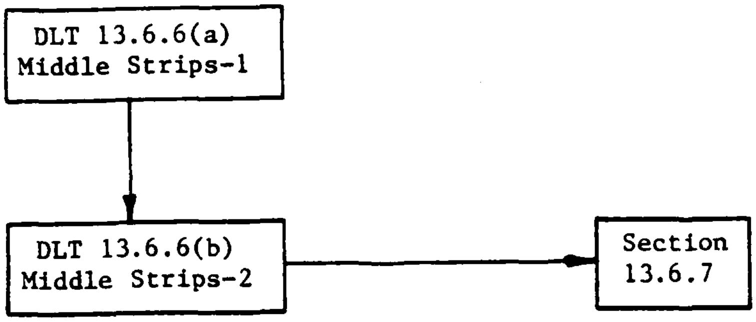
Comment: 1) DLT 13.6.5(b) covers Section 13.6.5.2.

Datum 13.6.5(c)	Source	Label	Number
If beams proportioned to resist moments caused by loads applied directly on beams in addition to moments calculated according to Sections 13.6.5.1 and 13.6.5.2.	X		

DLT 13.6.5(c) Applied Loads		1	2
C1	Beams proportioned to resist moments caused by loads applied directly on beams?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT 13.6.6(a)	X	X

Comment: 1) DLT 13.6.5(c) covers Section 13.6.5.3.

Section 13.6.6 Map



Section 13.6.6 Factored Moments in Middle Strips

Datum 13.6.6(a)	Source	Label	Number
If that portion of negative and positive factored moment not resisted by column strips proportionately assigned to half-middle strips.	X		
If each middle strip proportioned to resist the sum of the moments assigned to its two half-middle strips.	X		

DLT 13.6.6(a) Middle Strips - 1		1	2	3
C1	That portion of negative and positive factored moment not resisted by column strips proportionately assigned to half-middle strips?	Y	Y	N
C2	Each middle strip proportioned to resist the sum of the moments assigned to its two half-middle strips?	Y	N	I
A1	Provision = satisfied	X		
A2	Provision ≠ satisfied		X	X
A3	DLT 13.6.6(b)	X	X	X

Comment: 1) DLT 13.6.6(a) covers Sections 13.6.6.1 and 13.6.6.2.

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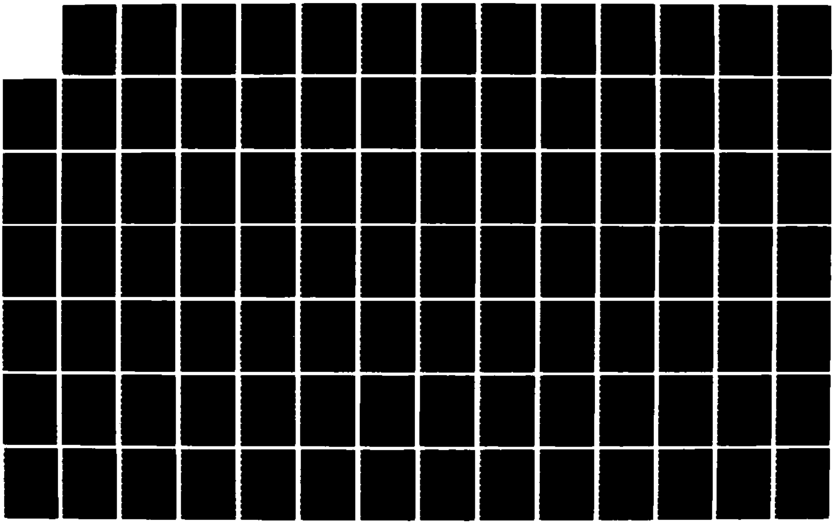

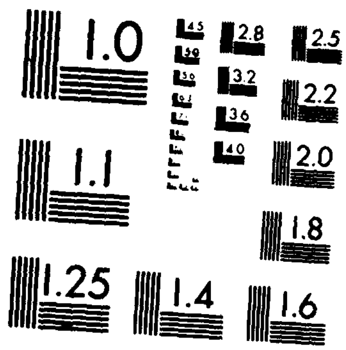

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Datum 13.6.6(b)	Source	Label	Number
If a middle strip adjacent to and parallel with an edge support.	X		
If the strip proportioned to resist twice the moment assigned to the half-middle strip corresponding to the first row of interior supports.	X		

DLT 13.6.6(b) Middle Strips-2		1	2	3
C1	Middle strip adjacent to and parallel with an edge support?	Y	Y	N
C2	Strip proportioned to resist twice the moment assigned to the half-middle strip corresponding to the first row of interior supports?	Y	N	I
A1	Provision = satisfied	X		
A2	Provision ≠ satisfied		X	
A3	DLT 13.6.7(a)	X	X	X

Comment: 1) DLT 13.6.6(b) covers Section 13.6.6.3.

Section 13.6.7 Map

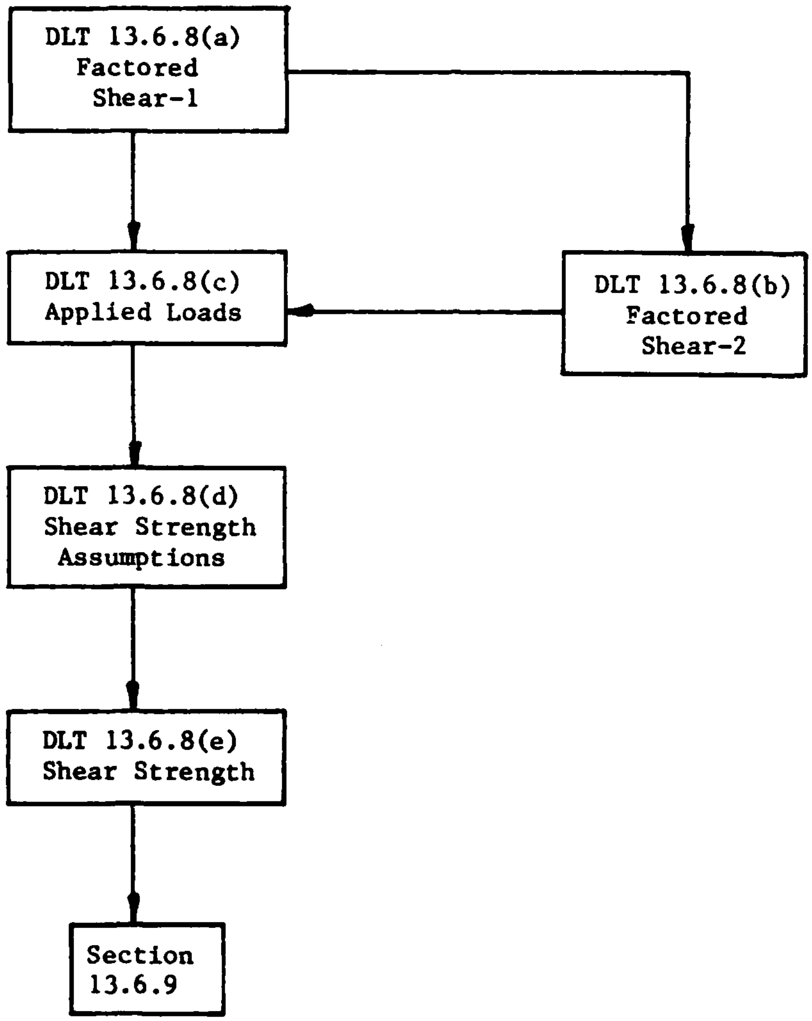
Section 13.6.7 Modification of Factored Moments

Datum 13.6.7(a)	Source	Label	Number
If negative and postive factored moments modified by 10%.	X		
Total static moment for a panel in the direction considered.	X		
Factored load per unit area.	X	w_u	
Length of span transverse to direction that moments are being determined, measured center-to-center of supports.	X	ℓ_2	
Length of clear span in direction that moments are being determined, measured face-to-face of supports.	X	ℓ_n	

DLT 13.6.7(a)	Modification of Factored Moments	1	2	3
C1	Negative and positive factored moments modified by 10%?	Y	Y	N
C2	The total static moment for a panel in the direction considered is > $w_u \ell_2 \ell_n^2/8$?	Y	N	I
A1	Provision = satisfied	X		
A2	Provision ≠ satisfied		X	
A3	DLT 13.6.8(a)	X	X	X

Comment: 1) DLT 13.6.7(a) covers Section 13.6.7.

Section 13.6.8 Map



Section 13.6.8 Factored Shear in Slab Systems with Beams

Datum 13.6.8(a)	Source	Label	Number
Length of span in direction moments are being determined measured center-to-center of supports.	X	ℓ_1	
Length of span transverse to ℓ_1, measured center-to-center of supports.	X	ℓ_2	
Ratio of flexural stiffness of beam section to flexural stiffness of a width of slab bounded laterally by center lines of adjacent panels (if any) on each side of the beam in the direction moments are being determined.	X	α_1	
Shear caused by factored loads on tributary areas bounded by 45° lines drawn from the corners of the panels and the center lines of the adjacent panels parallel to the long sides.	X	$\overline{V}$	
If beams proportioned to resist $\overline{V}$.	X		

DLT 13.6.8(a)	Factored Shear - 1	1	2	3
C1	$\frac{\alpha_1 \ell_2}{\ell_1} \geq 1$?	Y	Y	N
C2	Beams proportioned to resist $\overline{V}$?	Y	N	I
A1	Provision = satisfied	X		
A2	Provision ≠ satisfied		X	
A3	DLT 13.6.8(b)			X
A4	DLT 13.6.8(c)	X	X	

Comment: 1) DLT 13.6.8(a) covers Section 13.6.8.1.

Datum 13.6.8(b)	Source	Label	Number
Length of span in direction moments are being determined measured center-to-center of supports.	X	ℓ_1	
Length of span transverse to ℓ_1, measured center-to-center of supports.	X	ℓ_2	
Ratio of flexural stiffness of beam section to flexural stiffness of a width of slab bounded laterally by center lines of adjacent panels (if any) on each side of the beam in the direction moments are being determined.	X	α_1	
If beams proportioned to resist shear obtained by linear interpolation, assuming beams carry no load at $\alpha = 0$.	X		

DLT 13.6.8(b)	Factored Shear - 2	1	2
C1	$\frac{\alpha_1 \ell_2}{\ell_1} < 1$?	Y	N
C2	Beams proportioned to resist shear obtained by linear interpolation, assuming beams carry no load at = 0?	I	I
A1	Provision = satisfied	X	
A2	DLT 13.6.8(c)	X	X

Comment: 1) DLT 13.6.8(b) covers Section 13.6.8.2.

Datum 13.6.8(c)	Source	Label	Number
If beams proportioned to resist shears caused by factored loads applied directly on beams in addition to shears calculated according to 13.6.8.1 and 13.6.8.2.	X		

DLT 13.6.8(c) Applied Loads		1	2
C1	Beams proportioned to resist shears caused by factored loads applied directly on beams in addition to shears calculated according to 13.6.8.1 and 13.6.8.2.	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT 13.6.8(d)	X	X

Comment: 1) DLT 13.6.8(c) covers Section 13.6.8.3.

Datum 13.6.8(d)	Source	Label	Number
If slab shear strength computed on the assumption that load is distributed to supporting beams.	X		
If provisions of Section 13.6.8.1 satisfied.	DLT 13.6.8(a)		
If provisions of Section 13.6.8.2 satisfied.	DLT 13.6.8(b)		

DLT 13.6.8(d) Shear Strength Assumptions		1	2	3	4
C1	Slab shear strength computed on the assumption that load is distributed to supporting beams?	Y	Y	Y	N
C2	Provisions of Section 13.6.8.1 satisfied?	Y	Y	N	I
C3	Provisions of Section 13.6.8.2 satisfied?	Y	N	I	I
A1	Provision = satisfied	X			
A2	Provision ≠ satisfied		X	X	
A3	DLT 13.6.8(e)	X	X	X	X

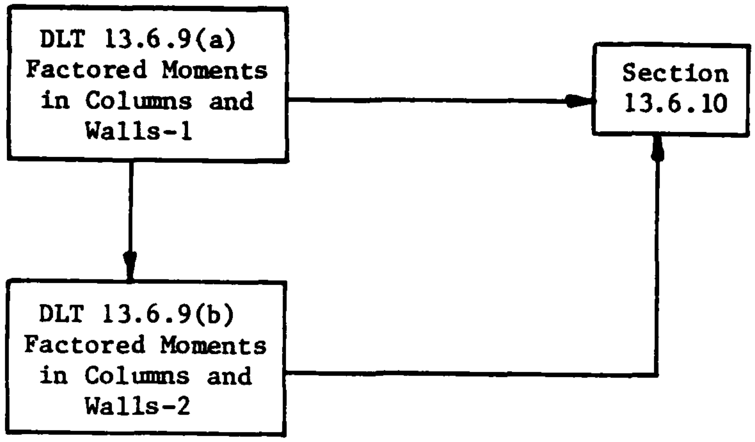
Comment: 1) DLT 13.6.8(d) covers Section 13.6.8.4.

Datum 13.6.8(e)	Source	Label	Number
If resistance to total shear occurring on panel provided.	X		
If shear strength satisfies requirements of Chapter 11.	X		

DLT 13.6.8(e)	Shear Strength	1	2	3
C1	Resistance to total shear occurring on panel provided?	Y	Y	N
C2	Shear strength satisfies requirements of Chapter 11?	Y	N	I
A1	Provision = satisfied	X		
A2	Provision ≠ satisfied		X	X
A3	DLT 13.6.8(f)	X	X	X

Comments: 1) DLT 13.6.8(e) partially covers Section 13.6.8.4 and covers Section 13.6.8.5.

Section 13.6.9 Map



Section 13.6.9 Factored Moments in Columns and Walls

Datum 13.6.9(a)	Source	Label	Number
If columns and walls built integrally with slab system resist moments caused by factored loads on the slab system.	X		
If an interior support.	X		
Factored dead load per unit area.	X	W_d	
Factored live load per unit area.	X	W_ℓ	
Length of span transverse to direction moments are being determined, measured center-to-center of supports.	X	ℓ_2	
Length of clear span in direction moments are being determined, measured face-to-face of supports.	X	ℓ_n	
Ratio of flexural stiffness of equivalent column to combined flexural stiffness of the slabs and beams at a joint taken in the direction of the span for which moments are being determined.	X	α_{ec}	

DLT 13.6.9(a)	Factored Moments in Columns and Walls-1	1	2	3	4
C1	Columns and walls built integrally with slab system resist moments caused by factored loads on the slab system?	Y	Y	N	N
C2	Column or wall is an interior support?	Y	N	Y	N
A1	Provision = satisfied	X	X		
A2	Provision ≠ satisfied			X	X
A3*	RM = $0.08\left[(W_d+0.5W_\ell)\ell_2\ell_n^2 - W_d'\ell_2'(\ell_n')^2\right] / (1 + 1/\alpha_{ec})$	X		X	
A4	DLT 13.6.9(b)	X		X	
A5	DLT 13.6.10(a)		X		X

Comment:

1) DLT 13.6.9(a) covers Section 13.6.9.1 and part of Section 13.6.9.2.

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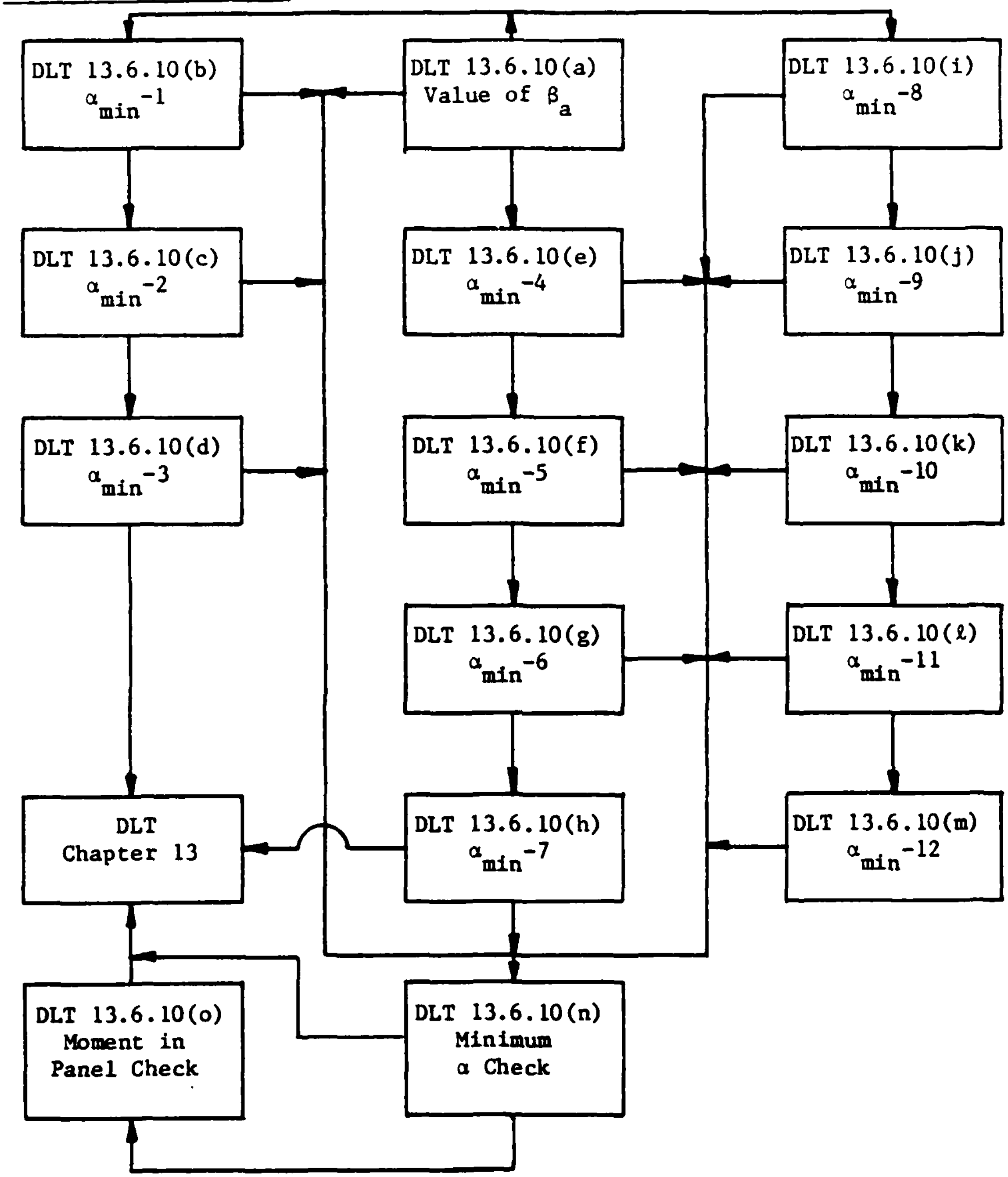
* W_d', ℓ_2', and ℓ_n' refer to shorter span.

Datum 13.6.9(b)	Source	Label	Number
Moment resistance provided by supporting elements above and below the slab in direction proportional to their stiffness.	X	PM	
If a general analysis is made.	X		
Required moment to be resisted by supporting elements above and below the slab.	DLT 13.6.9(a)	RM	

DLT 13.6.9(b)	Moments in Columns and Walls - 2	1	2	3
C1	PM $\geq$ RM?	Y	N	N
C2	General analysis made?	I	Y	N
A1	Provision = satisfied	X	X	
A2	Provision $\neq$ satisfied			X
A3	DLT 13.6.10(a)	X	X	X

Comment: 1) DLT 13.6.9(b) covers Section 13.6.9.2.

Section 13.6.10 Map



Section 13.6.10 Provisions for the Effects of Pattern Loadings

Datum 13.6.10(a)	Source	Label	Number
Ratio of dead load per unit area to live load per unit area (in each case without load factors).	X	β_a	

DLT 13.6.10(a) Value of β_a		1	2	3	4	5	6	
C1	$\beta_a > 2$?	Y	N	N	N	N	N	E
C2	$\beta_a = 2$?	N	Y	N	N	N	N	L
C3	$\beta_a = 1.0$?	N	N	Y	N	N	N	S
C4	$\beta_a = 0.5$?	N	N	N	Y	N	N	E
C5	$\beta_a = 0.33$?	N	N	N	N	Y	N	
A1	$\alpha_{min} = 0$		X					
A2	DLT Chapter 13	X						
A3	DLT 13.6.10(b)			X				
A4	DLT 13.6.10(e)				X			
A5	DLT 13.6.10(i)					X		
A6	DLT 13.6.10(n)		X					
A7	No Provision						X	
A8	Logical Error							X

Comments:

1) DLT 13.6.10(a) partially covers Table 13.6.10.

2) The first sentence of Section 13.6.10 should be changed to "...is less than or equal to 2, one..." because Table 13.6.10 presents values (zero) for $\beta = 2$.

3) Because the Code does not indicate that interpolation may be done between values presented that the user should use the value of β_a , ℓ_2/ℓ_1 , and α in this DLT and the other DLT's of this section to determine α_{min} .

(Continued)

Comments (Continued)

4) The phraseology in paragraphs (a) and (b) of Section 13.6.10 is contradictory. In paragraph (a) it is stated that α_c shall not be less than α_{min}, however, in paragraph (b) provisions are made for cases when α_c is less than α_{min}.

Datum 13.6.10(b)	Source	Label	Number
Ratio of flexural stiffness of beam section to flexural stiffness of a width of slab bounded laterally by center lines of adjacent panels (if any) on each side of the beam.	X	α_1*	
Modulus of elasticity of beam concrete.	X	E_{cb}	
Modulus of elasticity of slab concrete.	X	E_{cs}	
Moment of inertia about centroidal axis of gross section of beam as defined in Section 13.2.4.	X	I_b	
Moment of inertia about centroidal axis of gross section of slab, $h^3/12$ times width of slab defined in α.	X	I_s	
Length of span in direction of moments are being determined, measured center-to-center of supports.	X	ℓ_1	
Length of span transverse to ℓ_1, measured center-to-center of supports.	X	ℓ_2	

(Continued)

* $\alpha_1 = \frac{E_{cb} I_b}{E_{cs} I_s}$.

DLT 13.6.10(b) α_{min} - 1		1	2	3	4	5	6	7	
C1	α = 0?	Y	Y	Y	Y	Y	Y	N	
C2	ℓ_2/ℓ_1 = 0.5?	Y	N	N	N	N	N	I	E
C3	ℓ_2/ℓ_1 = 0.8?	N	Y	N	N	N	N	I	L
C4	ℓ_2/ℓ_1 = 1.0?	N	N	Y	N	N	N	I	S
C5	ℓ_2/ℓ_1 = 1.25?	N	N	N	Y	N	N	I	E
C6	ℓ_2/ℓ_1 = 2.0?	N	N	N	N	Y	N	I	
A1	α_{min} = 0.6	X							
A2	α_{min} = 0.7		X						
A3	α_{min} = 0.7			X					
A4	α_{min} = 0.8				X				
A5	α_{min} = 1.2					X			
A6	DLT 13.6.10(n)	X	X	X	X	X	X		
A7	DLT 13.6.10(c)							X	
A8	Logical Error								X

Comment:

1) DLT 13.6.10(b) partially covers Table 13.6.10.

Datum 13.6.10(c)	Source	Label	Number
Ratio of flexural stiffness of beam section to flexural stiffness of a width of slab bounded laterally by center lines of adjacent panels (if any) on each side of the beam.	X	α*	
Modulus of elasticity of beam concrete.	X	E_{cb}	
Modulus of elasticity of slab concrete.	X	E_{cs}	
Moment of inertia about centroidal axis of gross section of beam as defined in Section 13.2.4.	X	I_b	
Moment of inertia about centroidal axis of gross section of slab, $h^3/12$ times width of slab defined in α.	X	I_s	
Length of span in direction moments are being determined, measured center-to-center of supports.	X	ℓ_1	
Length of span transverse to ℓ_1, measured center-to-center of supports.	X	ℓ_2	

(Continued)

* $\alpha = \frac{E_{cb} I_b}{E_{cs} I_s}$.

DLT 13.6.10(c) α_{min} - 2		1	2	3	4	5	6	7	
C1	α = 0.5?	Y	Y	Y	Y	Y	Y	N	
C2	ℓ_2/ℓ_1 = 0.5?	Y	N	N	N	N	N	I	E
C3	ℓ_2/ℓ_1 = 0.8?	N	Y	N	N	N	N	I	L
C4	ℓ_2/ℓ_1 = 1.0?	N	N	Y	N	N	N	I	S
C5	ℓ_2/ℓ_1 = 1.25?	N	N	N	Y	N	N	I	E
C6	ℓ_2/ℓ_1 = 2.0?	N	N	N	N	Y	N	I	
A1	α_{min} = 0	X							
A2	α_{min} = 0		X						
A3	α_{min} = 0.1			X					
A4	α_{min} = 0.4				X				
A5	α_{min} = 0.5					X			
A6	DLT 13.6.10(n)	X	X	X	X	X	X		
A7	DLT 13.6.10(d)							X	
A8	Logical Error								X

Comment:

1) DLT 13.6.10(c) partially covers Table 13.6.10.

Datum 13.6.10(d)	Source	Label	Number
Ratio of flexural stiffness of beam section to flexural stiffness of a width of slab bounded laterally by center lines of adjacent panels (if any) on each side of the beam.	X	α*	
Modulus of elasticity of beam concrete.	X	E_{cb}	
Modulus of elasticity of slab concrete.	X	E_{cs}	
Moment of inertia about centroidal axis of gross section of beam as defined in Section 13.2.4.	X	I_b	
Length of span in direction moments are being determined, measured center-to-center of supports.	X	ℓ_1	
Moment of inertia about centroidal axis of gross section of slab, $h^3/12$ times width of slab defined in α.	X	I_s	
Length of span transverse to ℓ_1, measured center-to-center of supports.		ℓ_2	

DLT 13.6.10(d)	α_{min} - 3	1	2	3	4	
C1	α = 1.0?	Y	Y	N	N	E L S E
C2	α = 2.0 or 4.0?	N	N	Y	N	
C3	ℓ_2/ℓ_1 = 2.0?	Y	N	I	I	
A1	α_{min} = 0.2	X				
A2	α_{min} = 0		X	X		
A3	DLT 13.6.10(n)	X	X	X		
A4	No Provisions DLT Chapter 13				X	
A5	Logical Error					X

Comment:

1) DLT 13.6.10(d) partially covers Table 13.6.10.

* $\alpha = \frac{E_{cb} I_b}{E_{cs} I_s}$.

Datum 13.6.10(e)	Source	Label	Number
Ratio of flexural stiffness of beam section to flexural stiffness of a width of slab bounded laterally by center lines of adjacent panels (if any) on each side of the beam.	X	α*	
Modulus of elasticity of beam concrete.	X	E_{cb}	
Modulus of elasticity of slab concrete.	X	E_{cs}	
Moment of inertia about centroidal axis of gross section of beam as defined in Section 13.2.4.	X	I_b	
Moment of inertia about centroidal axis of gross section of slab, $h^3/12$ times width of slab defined in α.	X	I_s	
Length of span in direction moments are being determined, measured center-to-center of supports.	X	ℓ_1	
Length of span transverse to ℓ_1, measured center-to-center of supports.	X	ℓ_2	

(Continued)

* $\alpha = \dfrac{E_{cb} I_b}{E_{cs} I_s}$.

DLT 13.6.10(e) α_{min} - 4		1	2	3	4	5	6	7	
C1	α = 0?	Y	Y	Y	Y	Y	Y	N	
C2	ℓ_2/ℓ_1 = 0.5?	Y	N	N	N	N	N		E
C3	ℓ_2/ℓ_1 = 0.8?	N	Y	N	N	N	N		L
C4	ℓ_2/ℓ_1 = 1.0?	N	N	Y	N	N	N		S
C5	ℓ_2/ℓ_1 = 1.25?	N	N	N	Y	N	N		E
C6	ℓ_2/ℓ_1 = 2.0?	N	N	N	N	Y	N		
A1	α_{min} = 1.3	X							
A2	α_{min} = 1.5		X						
A3	α_{min} = 1.6			X					
A4	α_{min} = 1.9				X				
A5	α_{min} = 4.9					X			
A6	DLT 13.6.10(n)	X	X	X	X	X	X		
A7	DLT 13.6.10(f)							X	
A8	Logical Error								X

Comment:

1) DLT 13.6.10(e) partially covers Table 13.6.10.

Datum 13.6.10(f)	Source	Label	Number
Ratio of flexural stiffness of beam section to flexural stiffness of a width of slab bounded laterally by center lines of adjacent panels (if any) on each side of the beam.	X	α*	
Modulus of elasticity of beam concrete.	X	E_{cb}	
Modulus of elasticity of slab concrete.	X	E_{cs}	
Moment of inertia about centroidal axis of gross section of beam as defined in Section 13.2.4.	X	I_b	
Moment of inertia about centroidal axis of gross section of slab, $h^3/12$ times width of slab defined in α.	X	I_s	
Length of span in direction moments are being determined, measured center-to-center of supports.	X	ℓ_1	
Length of span transverse to ℓ_1, measured center-to-center of supports.	X	ℓ_2	

(Continued)

* $\alpha = \frac{E_{cb} I_b}{E_{cs} I_s}$.

DLT 13.6.10(f) α_{min} - 5		1	2	3	4	5	6	7	
C1	α = 0.5?	Y	Y	Y	Y	Y	Y	N	
C2	ℓ_2/ℓ_1 = 0.5?	Y	N	N	N	N	N		E
C3	ℓ_2/ℓ_1 = 0.8?	N	Y	N	N	N	N		L
C4	ℓ_2/ℓ_1 = 1.0?	N	N	Y	N	N	N		S
C5	ℓ_2/ℓ_1 = 1.25?	N	N	N	Y	N	N		E
C6	ℓ_2/ℓ_1 = 2.0?	N	N	N	N	Y	N		
A1	α_{min} = 0.3	X							
A2	α_{min} = 0.5		X						
A3	α_{min} = 0.6			X					
A4	α_{min} = 1.0				X				
A5	α_{min} = 1.6					X			
A6	DLT 13.6.10(n)	X	X	X	X	X	X		
A7	DLT 13.6.10(g)							X	
A8	Logical Error								X

Comment:

1) DLT 13.6.10(f) partially covers Table 13.6.10.

Datum 13.6.10(g)	Source	Label	Number
Ratio of flexural stiffness of beam section to flexural stiffness of a width of slab bounded laterally by center lines of adjacent panels (if any) on each side of the beam.	X	α*	
Length of span in direction moments are being determined, measured center-to-center of supports.	X	ℓ_1	
Length of span transverse to ℓ_1, measured center-to-center of supports.	X	ℓ_2	

(Continued)

* $\alpha = \frac{E_{cb} I_b}{E_{cs} I_s}$.

DLT 13.6.10(g) α_{min} - 6		1	2	3	4	5	6	7	
C1	α = 1.0?	Y	Y	Y	Y	Y	Y	N	
C2	ℓ_2/ℓ_1 = 0.5?	Y	N	N	N	N	N		E
C3	ℓ_2/ℓ_1 = 0.8?	N	Y	N	N	N	N		L
C4	ℓ_2/ℓ_1 = 1.0?	N	N	Y	N	N	N		S
C5	ℓ_2/ℓ_1 = 1.25?	N	N	N	Y	N	N		E
C6	ℓ_2/ℓ_1 = 2.0?	N	N	N	N	Y	N		
A1	α_{min} = 0	X							
A2	α_{min} = 0.2		X						
A3	α_{min} = 0.2			X					
A4	α_{min} = 0.5				X				
A5	α_{min} = 0.8					X			
A6	DLT 13.6.10(n)	X	X	X	X	X	X		
A7	DLT 13.6.10(h)							X	
A8	Logical Error								X

Comment:

1) DLT 13.6.10(g) partially covers Table 13.6.10.

Datum 13.6.10(h)	Source	Label	Number
Ratio of flexural stiffness of beam section to flexural stiffness of a width of slab bounded laterally by center lines of adjacent panels (if any) on each side of the beam.	X	α*	
Length of span in direction moments are being determined, measured center-to-center of supports.	X	ℓ_1	
Length of span transverse to ℓ_1, measured center-to-center of supports.	X	ℓ_2	

DLT 13.6.10(h) α_{min} - 7		1	2	3	4	5	6	
C1	α = 2.0?	Y	N	Y	N	N	N	E L S E
C2	α = 4.0?	N	Y	N	Y	N	N	
C3	ℓ_2/ℓ_1 = 2.0?	Y	Y	N	N	Y	N	
A1	α_{min} = 0.3	X						
A2	α_{min} = 0		X	X	X			
A3	DLT 13.6.10(n)	X	X	X	X			
A4	No Provision DLT Chapter 13					X	X	
A5	Logical Error							X

Comment:

1) DLT 13.6.10(h) partially covers Table 13.6.10.

---

* $\alpha = \frac{E_{cb} I_b}{E_{cs} I_s}$.

Datum 13.6.10(i)	Source	Label	Number
Ratio of flexural stiffness of beam section to flexural stiffness of a width of slab bounded laterally by center lines of adjacent panels (if any) on each side of the beam.	X	α*	
Modulus of elasticity of beam concrete.	X	E_{cb}	
Modulus of elasticity of slab concrete.	X	E_{cs}	
Moment of inertia about centroidal axis of gross section of beam as defined in Section 13.2.4.	X	I_b	
Moment of inertia about centroidal axis of gross section of slab, $h^3/12$ times width of slab defined in α.	X	I_s	
Length of span in direction moments are being determined, measured center-to-center of supports.	X	ℓ_1	
Length of span transverse to ℓ_1, measured center-to-center of supports.	X	ℓ_2	

(Continued)

* $\alpha = \dfrac{E_{cb} I_b}{E_{cs} I_s}$.

DLT 13.6.10(i) α_{min} - 8		1	2	3	4	5	6	7	
C1	α = 0?	Y	Y	Y	Y	Y	Y	N	
C2	ℓ_2/ℓ_1 = 0.5?	Y	N	N	N	N	N	I	E
C3	ℓ_2/ℓ_1 = 0.8?	N	Y	N	N	N	N	I	L
C4	ℓ_2/ℓ_1 = 1.0?	N	N	Y	N	N	N	I	S
C5	ℓ_2/ℓ_1 = 1.25?	N	N	N	Y	N	N	I	E
C6	ℓ_2/ℓ_1 = 2.0?	N	N	N	N	Y	N	I	
A1	α_{min} = 1.8	X							
A2	α_{min} = 2.0		X						
A3	α_{min} = 2.3			X					
A4	α_{min} = 2.8				X				
A5	α_{min} = 13.0					X			
A6	DLT 13.6.10(n)	X	X	X	X	X	X		
A7	DLT 13.6.10(j)							X	
A8	Logical Error								X

Comment:

1) DLT 13.6.10(i) partially covers Table 13.6.10.

Datum 13.6.10(j)	Source	Label	Number
Ratio of flexural stiffness of beam section to flexural stiffness of a width of slab bounded laterally by center lines of adjacent panels (if any) on each side of the beam.	X	α*	
Modulus of elasticity of beam concrete.	X	E_{cb}	
Modulus of elasticity of slab concrete.	X	E_{cs}	
Moment of inertia about centroidal axis of gross section of beam as defined in Section 13.2.4.	X	I_b	
Moment of inertia about centroidal axis of gross section of slab, $h^3/12$ times width of slab defined in α.	X	I_s	
Length of span in direction moments are being determined, measured center-to-center of supports.	X	ℓ_1	
Length of span transverse to ℓ_1, measured center-to-center of supports.	X	ℓ_2	

(Continued)

* $\alpha = \dfrac{E_{cb} I_b}{E_{cs} I_s}$.

DLT 13.6.10(j) α_{min} - 9		1	2	3	4	5	6	7	
C1	α = 0.5?	Y	Y	Y	Y	Y	Y	N	
C2	ℓ_2/ℓ_1 = 0.5?	Y	N	N	N	N	N		E
C3	ℓ_2/ℓ_1 = 0.8?	N	Y	N	N	N	N		L
C4	ℓ_2/ℓ_1 = 1.0?	N	N	Y	N	N	N		S
C5	ℓ_2/ℓ_1 = 1.25?	N	N	N	Y	N	N		E
C6	ℓ_2/ℓ_1 = 2.0?	N	N	N	N	Y	N		
A1	α_{min} = 0.5	X							
A2	α_{min} = 0.9		X						
A3	α_{min} = 0.9			X					
A4	α_{min} = 1.5				X				
A5	α_{min} = 2.6					X			
A6	DLT 13.6.10(n)	X	X	X	X	X	X		
A7	DLT 13.6.10(k)							X	
A8	Logical Error								X

Comment:

1) DLT 13.6.10(j) partially covers Table 13.6.10.

Datum 13.6.10(k)	Source	Label	Number
Ratio of flexural stiffness of beam section to flexural stiffness of a width of slab bounded laterally by center lines of adjacent panels (if any) on each side of the beam.	X	α*	
Modulus of elasticity of beam concrete.	X	E_{cb}	
Modulus of elasticity of slab concrete.	X	E_{cs}	
Moment of inertia about centroidal axis of gross section of beam as defined in Section 13.2.4.	X	I_b	
Moment of inertia about centroidal axis of gross section of slab, $h^3/12$ times width of slab defined in α.	X	I_s	
Length of span in direction moments are being determined, measured center-to-center of supports.	X	ℓ_1	
Length of span transverse to ℓ_1, measured center-to-center of supports.	X	ℓ_2	

(Continued)

* $\alpha = \dfrac{E_{cb} I_b}{E_{cs} I_s}$.

DLT 13.6.10(k) α_{min} - 10		1	2	3	4	5	6	7	
C1	α = 1.0?	Y	Y	Y	Y	Y	Y	N	
C2	ℓ_2/ℓ_1 = 0.5?	Y	N	N	N	N	N	I	E
C3	ℓ_2/ℓ_1 = 0.8?	N	Y	N	N	N	N	I	L
C4	ℓ_2/ℓ_1 = 1.0?	N	N	Y	N	N	N	I	S
C5	ℓ_2/ℓ_1 = 1.25?	N	N	N	Y	N	N	I	E
C6	ℓ_2/ℓ_1 = 2.0?	N	N	N	N	Y	N	I	
A1	α_{min} = 0.1	X							
A2	α_{min} = 0.3		X						
A3	α_{min} = 0.4			X					
A4	α_{min} = 0.8				X				
A5	α_{min} = 1.2					X			
A6	DLT 13.6.10(n)	X	X	X	X	X	X		
A7	DLT 13.6.10(ℓ)							X	
A8	Logical Error								X

Comment:

1) DLT 13.6.10(k) partially covers Table 13.6.10.

Datum 13.6.10(ℓ)	Source	Label	Number
Ratio of flexural stiffness of beam section to flexural stiffness of a width of slab bounded laterally by center lines of adjacent panels (if any) on each side of the beam.	X	α*	
Modulus of elasticity of beam concrete.	X	E_{cb}	
Modulus of elasticity of slab concrete.	X	E_{cs}	
Moment of inertia about centroidal axis of gross section of beam as defined in Section 13.2.4.	X	I_b	
Moment of inertia about centroidal axis of gross section of slab, $h^3/12$ times width of slab defined in α.	X	I_s	
Length of span in direction moments are being determined, measured center-to-center of supports.	X	ℓ_1	
Length of span transverse to ℓ_1, measured center-to-center of supports.	X	ℓ_2	

(Continued)

* $\alpha = \dfrac{E_{cb} I_b}{E_{cs} I_s}$.

DLT 13.6.10(ℓ) α_{min} - 11		1	2	3	4	5	6	7	
C1	α = 2.0?	Y	Y	Y	Y	Y	Y	N	
C2	ℓ_2/ℓ_1 = 0.5?	Y	N	N	N	N	N	I	E
C3	ℓ_2/ℓ_1 = 0.8?	N	Y	N	N	N	N	I	L
C4	ℓ_2/ℓ_1 = 1.0?	N	N	Y	N	N	N	I	S
C5	ℓ_2/ℓ_1 = 1.25?	N	N	N	Y	N	N	I	E
C6	ℓ_2/ℓ_1 = 2.0?	N	N	N	N	Y	N	I	
A1	α_{min} = 0	X							
A2	α_{min} = 0		X						
A3	α_{min} = 0			X					
A4	α_{min} = 0.2				X				
A5	α_{min} = 0.5					X			
A6	DLT 13.6.10(n)	X	X	X	X	X	X		
A7	DLT 13.6.10(m)							X	
A8	Logical Error								X

Comment:

1) DLT 13.6.10(ℓ) partially covers Table 13.6.10.

Datum 13.6.10(m)	Source	Label	Number
Ratio of flexural stiffness of beam section to flexural stiffness of a width of slab bounded laterally by center lines of adjacent panels (if any) on each side of the beam.	X	α*	
Modulus of elasticity of beam concrete.	X	E_{cb}	
Modulus of elasticity of slab concrete.	X	E_{cs}	
Moment of inertia about centroidal axis of gross section of beam as defined in Section 13.2.4.	X	I_b	
Moment of inertia about centroidal axis of gross section fo slab, $h^3/12$ times width of slab defined in α.	X	I_s	
Length of span in direction moments are being determined, measured center-to-center of supports.	X	ℓ_1	
Length of span transverse to ℓ_1, measured center-to-center of supports.	X	ℓ_2	

DLT 13.6.10(m)	α_{min} - 12	1	2	3
C1	α = 4.0?	Y	Y	N
C2	ℓ_2/ℓ_1 = 2.0?	Y	N	I
A1	α_{min} = 0.3	X		
A2	α_{min} = 0		X	
A3	No Provision			X
A4	DLT 13.6.10(n)	X	X	X

Comment:

1) DLT 13.6.10(m) partially covers Table 13.6.10.

* $\alpha = \frac{E_{cb} I_b}{E_{cs} I_s}$.

Datum 13.6.10(n)	Source	Label	Number
Ratio of flexural stiffness of columns above and below the slab to combined flexural stiffness of the slabs and beams at a joint taken in the direction of the span for which moments are being determined.	X	α_c*	
Minimum α_c.	DLT 13.6.10 b → m	α_{min}	
Ratio of dead load per unit area to live load per unit area (in each case without load factors).	X	β_a	

DLT 13.6.10(n) Minimum α Check		1	2
C1	$\alpha_c \geq \alpha_{min}$?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	$\delta_s = 1 + \frac{2 - \beta_a}{4 + \beta_a}\left(1 - \frac{\alpha_c}{\alpha_{min}}\right)$		X
A4	DLT 13.6.10(o)		X
A5	DLT Ch. 13	X	

Comment:

1) DLT 13.6.10(n) covers part (a) of Section 13.6.10.

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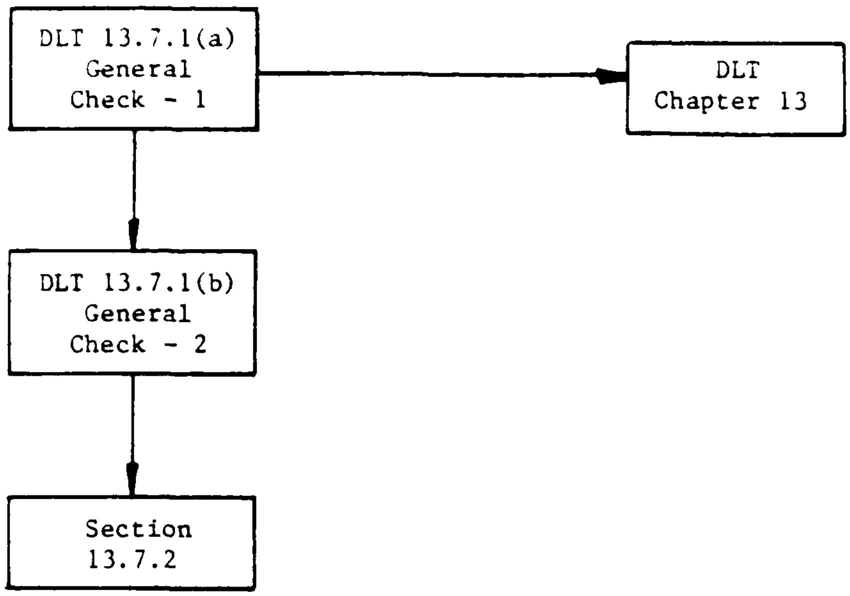
* $\alpha_c = \frac{\Sigma K_c}{\Sigma(K_s + K_b)}$

Datum 13.6.10(o)	Source	Label	Number
Factored positive moments in panels.	X	M_p	
Multiplication factor.	DLT 13.6.10(n)	δ_s	
Factored positive moment used in design.	X	DM_p	

DLT 13.6.10(o) Moment in Panel Check		1	2
C1	$DM_p = \delta_s M_p$?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT Ch. 13	X	X

Comment: 1) DLT 13.6.10(o) covers part (b) of Section 13.6.10.

Section 13.7.1 Map



Section 13.7 Equivalent Frame Method

Datum 13.7.1(a)	Source	Label	Number
If design of slab system by the Equivalent Frame Method is based on assumptions given in Sections 13.7.2 through 13.7.6.	X		
If all sections of slabs and supporting members proportioned for moments and shears obtained from Sections 13.7.2 through 13.7.6.	X		

DLT 13.7.1(a)	General Check - 1	1	2	3
C1	Design of slab system by the Equivalent Frame Method based on assumptions given in Sections 13.7.2 through 13.7.6?	Y	Y	N
C2	All sections of slabs and supporting members proportioned for moments and shears obtained from Sections 13.7.2 through 13.7.6?	Y	N	I
A1	Provision = satisfied	X		
A2	Provision ≠ satisfied		X	X
A3	DLT 13.7.1(b)	X		
A4	DLT Ch. 13		X	X

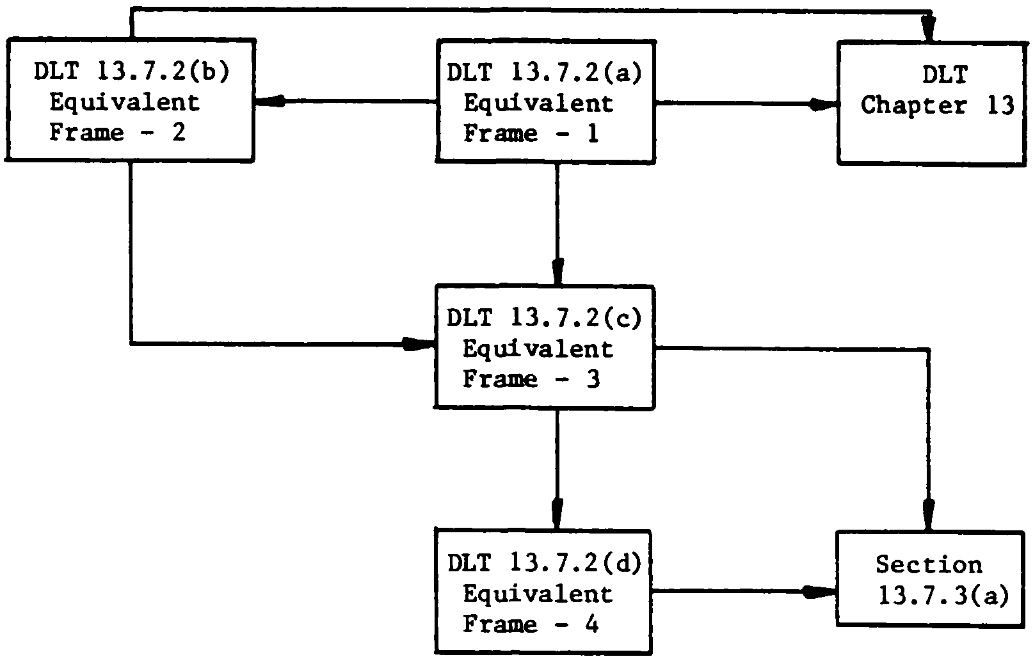
Comment: 1) DLT 13.7.1(a) covers Section 13.7.1.

Datum 13.7.1(b)	Source	Label	Number
If metal capitals are used.	X		
If the contribution of metal capitals to stiffness and resistance to moment and to shear accounted for.	X		
If changes in length of columns and slabs due to direct stress, and deflections due to shear neglected.	X		

DLT 13.7.1(b) General Check - 2		1	2
C1	Metal capitals used?	Y	N
C2	Contributions of metal capitals to stiffness and resistance to moment and to shear taken into account?	I	
C3	Changes in length of columns and slabs due to direct stress and deflections due to shear neglected?	I	I
A1	Provision = satisfied	X	X
A2	DLT 13.7.2(a)	X	X

Comment: 1) DLT 13.7.1(b) covers Sections 13.7.1.1 and 13.7.1.2.

Section 13.7.2 Map



Section 13.7.2 Equivalent Frames

Datum 13.7.2(a)	Source	Label	Number
If the structure considered to be made up of equivalent frames on column lines taken longitudinally and transversely through the building.	X		
If frame consists of a row of equivalent columns or supports and slab-beam strips, bounded laterally by the center line of the panel on each side of the center line of columns or supports.	X		

DLT 13.7.2(a)	Equivalent Frame - 1	1	2	3
C1	The structure considered to be made up of equivalent frames on column lines taken longitudinally and transversely through the building?	Y	Y	N
C2	Frame consists of a row of equivalent columns or supports and slab-beam strips, bounded laterally by the center line of the panel on each side of the center line of columns or supports?	Y	N	I
A1	Provision = satisfied	X		
A2	Provision ≠ satisfied			X
A3	DLT 13.7.2(b)		X	
A4	DLT 13.7.2(c)	X		
A5	DLT Ch. 13			X

Comments: 1) DLT 13.7.2(a) covers Sections 13.7.2.1 and 13.7.2.2.

2) The word "each" is not included in C2 because two forms of equivalent frame are described.

Datum 13.7.2(b)	Source	Label	Number
If frame consists of a row of equivalent columns and slab-beam strips bounded by a parallel edge on one side and the center line of the adjacent panel on the other.	X		

DLT 13.7.2(b) Equivalent Frame - 2		1	2
C1	Frame consists of a row of equivalent columns and slab-beam strips bounded by a parallel edge on one side and the center line of the adjacent panel on the other?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT 13.7.2(c)	X	
A4	DLT Ch. 13		X

Comments: 1) DLT 13.7.2(b) covers Section 13.7.2.3.

2) It is assumed that if the equivalent frame is not per C2 of DLT 13.7.2(a) <u>or</u> C1 above, the method does not apply.

3) C1 is an interpretation of the meaning of Section 13.7.3.

Datum 13.7.2(c)	Source	Label	Number
If analysis is for vertical loading.	X		
If each equivalent frame analyzed in its entirety.	X		
If each floor and the roof (slab-beams) analyzed separately with far ends of columns considered fixed.	X		

DLT 13.7.2(c) Equivalent Frame - 3		1	2	3	4	5	
C1	Analysis is for vertical loading?	Y	Y	Y	N	N	E
C2	Each equivalent frame analyzed in its entirety.	Y	N	N	Y	N	L
							S
C3	Each floor and the roof (slab-beams) analyzed separately with far ends of columns considered fixed?	N	Y	N	N	I	E
A1	Provision = satisfied	X	X		X		
A2	Provision ≠ satisfied			X		X	
A3	DLT 13.7.2(d)	X	X	X			
A4	DLT 13.7.3(a)				X	X	
A5	Logical Error						X

Comments: 1) DLT 13.7.2(c) covers Section 13.7.2.4.

2) It is assumed that if the analysis is not for vertical loading, Section 13.7.2.5, i.e., DLT 13.7.2(d) need not be checked.

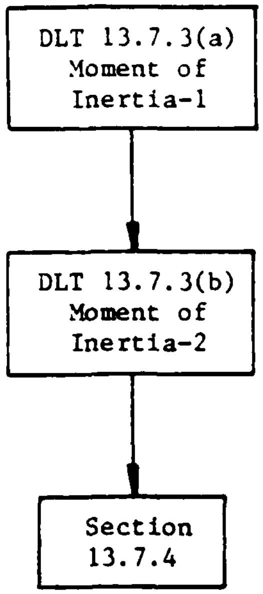
Datum 13.7.2(d)	Source	Label	Number
If slab-beams analyzed separately.	X		
If assumed that in determining moment at a given support that the slab-beam is fixed at any support two panels distant therefrom.	X		
If the slab continues beyond the point two panels distant.	X		

DLT 13.7.2(d)		1	2	3	4
C1	Slab-beams analyzed separately?	Y	Y	Y	N
C2	Assumed that in determining moment at a given support that the slab-beam is fixed at any support two panels distant therefrom?	Y	Y	N	I
C3	Slab continues beyond the point two panels distant?	Y	N	I	I
A1	Provision = satisfied	X		X	
A2	Provision ≠ satisfied		X		
A3	DLT 13.7.3(a)	X	X	X	X

Comments: 1) DLT 13.7.2(d) covers Section 13.7.2.5.

2) It is assumed that a separate slab-beam analysis may be done <u>in addition</u> to equivalent frame analysis.

Section 13.7.3 - Map



Section 13.7.3 Slab-Beams

Datum 13.7.3(a)	Source	Label	Number
If variation in moment of inertia along axis of slab-beams taken into account.	X		
If moment of inertia of slab-beams at any cross section outside of joints or capitals based on the gross area of concrete.	X		

DLT 13.7.3(a) Moment of Inertia - 1		1	2
C1	Variation in moment of inertia along axis of slab-beams taken into account?	Y	N
C2	Moment of inertia of slab-beams at any cross section outside of joints or column capitals based on the gross area of concrete?	I	I
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT 13.7.3(b)	X	X

Comment: 1) DLT 13.7.3(a) covers Section 13.7.3.1 and 13.7.3.2.

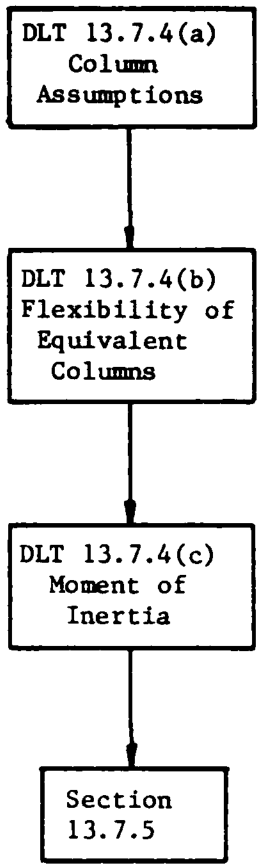
Datum 13.7.3(b)	Source	Label	Number
Moment of inertia of slab-beams from center of column to face of column, bracket, or capital.	X	I_{sc}	
Moment of inertia of the slab-beam at the face of column, bracket, or capital.	X	I_{sf}	
Size of rectangular or equivalent rectangular column, capital, or bracket measured transverse to the direction of the span for which moments are being determined.	X	c_2	
Length of span transverse to direction that moments are being determined, measured center-to-center of supports.	X	ℓ_2	

DLT 13.7.3(b) Moment of Inertia - 2		1	2
C1	$I_{sc} = \dfrac{I_{sf}}{\left(1 - \dfrac{c_2}{\ell_2}\right)^2}$?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT 13.7.4(a)	X	X

Comment:

1) DLT 13.7.3(b) covers Section 13.7.3.3.

Section 13.7.4 Map



Section 13.7.4 Equivalent Columns

Datum 13.7.4(a)	Source	Label	Number
If an equivalent column assumed to consist of the actual columns above and below the slab-beam plus an attached torsional member transverse to the direction of the span in which moments are being determined.	X		
If attached torsion member extends to bounding lateral panel center lines on each side of the column.	X		

DLT 13.7.4(a)	Column Assumptions	1	2	3
C1	Equivalent column assumed to consist of the actual columns above and below the slab-beam plus an attached torsional member transverse to the direction of the span in which moments are being determined?	Y	Y	N
C2	Attached torsional member extends to bounding lateral panel center lines on each side of the column?	Y	N	I
A1	Provision = satisfied	X		
A2	Provision ≠ satisfied		X	X
A3	DLT 13.7.4(b)	X	X	X

Comment: 1) DLT 13.7.4(a) covers Section 13.7.4.1.

Datum 13.7.4(b)	Source	Label	Number
Sum of flexural stiffnesses of actual columns above and below the slab-beam, moment per unit rotation.	X	ΣK_c	
Flexural stiffness of equivalent column, moment per unit rotation used in the design.	X	K_{ec}	
Torsional stiffness of attached torsional member, moment per unit rotation.	X	K_t	
If moment of inertia of columns, when computing K_c at any cross section outside of joints or column capitals is based on the gross area of concrete.	X		

DLT 13.7.4(b)	Flexibility of Equivalent Column	1	2
C1	$\frac{1}{K_{ec}} = \frac{1}{\Sigma K_c} + \frac{1}{K_t}$?	Y	N
C2	Moment of inertia of columns, when computing K_c, at any cross section outside of joints or column capitals based on the gross area of concrete?	I	I
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT 13.7.4(c)	X	X

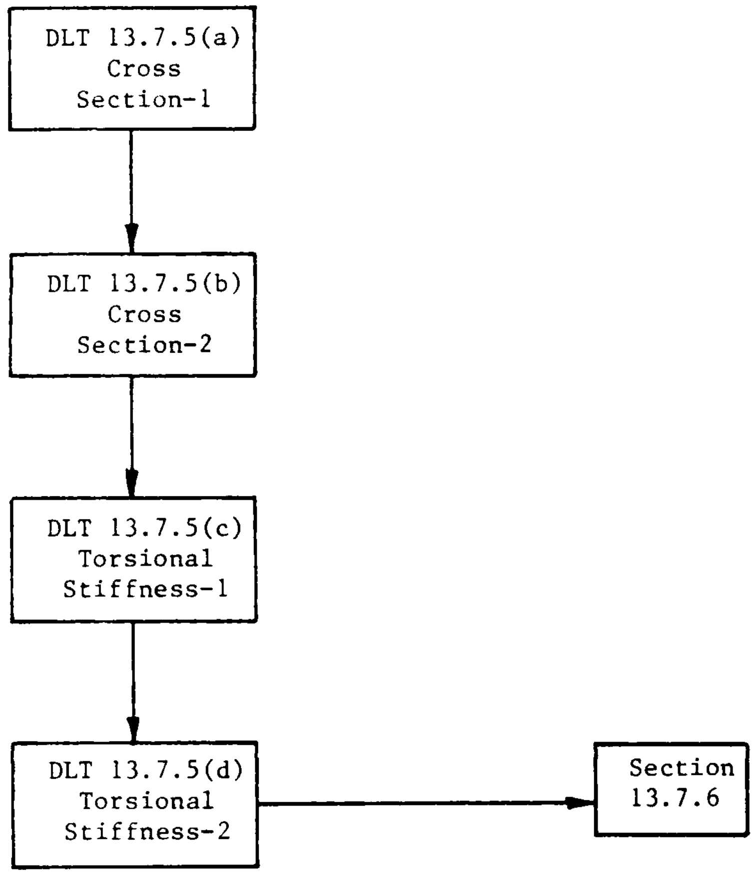
Comment: 1) DLT 13.7.4(b) covers Section 13.7.4.2 and 13.7.4.3.

Datum 13.7.4(c)	Source	Label	Number
If variation in moment of inertia along axis of columns taken into account.	X		
If the moment of inertia of columns assumed infinite from top to bottom of the slab-beam at a joint.	X		

DLT 13.7.4(c) Moment of Inertia		1	2	3
C1	Variation in moment of inertia along axis of columns taken into account?	Y	Y	N
C2	Moment of inertia of columns assumed infinite from top to bottom of the slab-beam at a joint?	Y	N	I
A1	Provision = satisfied	X		
A2	Provision ≠ satisfied		X	X
A3	DLT 13.7.5(a)	X	X	X

Comment: 1) DLT 13.7.4(c) covers Sections 13.7.4.4 and 13.7.4.5.

Section 13.7.5 Map



Section 13.7.5 Attached Torsional Members

Datum 13.7.5(a)	Source	Label	Number
If monolithic or fully composite construction.	X		
Width of column, capital or bracket in the direction of the span for which moments are being determined.	X	C_1	
Slab thickness.	X	h_s	
Width of transverse beam.	X	b_w	
Depth of transverse beam.	X	d_t	
Height of transverse beam above slab.	X	h_{wa}	
Height of transverse beam below slab.	X	h_{wb}	

DLT 13.7.5(a) Cross Section - 1		1	2
C1	Monolithic or fully composite construction?	Y	N
A1	$A_1 = C_1 h_s$	X	X
A2	$A_2 = 0$		X
A3	$A_2 = (C_1 h_s) + (h_{wa} + h_{wb}) b_w$	X	
A4	$A_3 = 0$		X
A5	$A_3 = b_w d_t + 2 h_s \left[\min[4 h_s, \max(h_{wa}, h_{wb})] \right]$	X	
A6	DLT 13.7.5(b)	X	X

Comment:

1) DLT 13.7.5(a) is a working DLT that partially covers Section 13.7.5.1.

Datum 13.7.5(b)	Source	Label	Number
If attached torsional member assumed to have a constant cross section throughout their length.	X		
Cross sectional area considered for torsional member.	X	A_c	
Cross sectional area required.	DLT 13.7.5(a)	$A_{1,2,3}$	

DLT 13.7.5(b) Cross Section - 2		1	2	3
C1	Attached torsional member assumed to have a constant cross section throughout the length?	Y	Y	N
C2	$A_c = \max[A_1, A_2, A_3]$?	Y	N	I
A1	Provision = satisfied	X		
A2	Provision ≠ satisfied		X	X
A3	DLT 13.7.5(c)	X	X	X

Comment: 1) DLT 13.7.5(b) covers Section 13.7.5.1.

Datum 13.7.5(c)	Source	Label	Number
Size of rectangular or equivalent rectangular column, capital, or bracket measured transverse to the direction of the span for which moments are being determined, in.	X	c_2	
Shorter overall dimension of rectangular part of cross section.	X	x	
Longer overall dimension of rectangular part of cross section.	X	y	
Length of span in direction that moments are being determined, measured center-to-center of supports.	X	ℓ_1	
Length of span transverse to ℓ_1, measured center-to-center of supports.	X	ℓ_2	
Cross-sectional constant to define torsional properties.	X	C	
Modulus of elasticity of slab concrete.	X	E_{cs}	
Moment of inertia about centroidal axis of gross section of beam.	X	I_b	
Moment of inertia about centroidal axis of gross section of beam and portion of slab to be included in torsional calculations.	X	I_{sb}	

(Continued)

DLT 13.7.5(c) Torsional Stiffness - 1		1	2
C1	Beams frame into columns in the direction of the span for which moments are being determined?	Y	N
A1*	$C = \sum \left(1 - 0.63 \frac{x}{y}\right) \frac{x^3 y}{3}$	X	X
A2	$K_t = \sum \frac{9 E_{cs} C}{\ell_2 \left(1 - \frac{c_2}{\ell_2}\right)^3}$	X	X
A3	$K_t = K_t \left(\frac{I_{sb}}{I_s}\right)$	X	
A4	DLT 13.7.5(d)	X	X

Comment:

1) DLT 13.7.5(c) covers Sections 13.7.5.4, 13.7.5.3, and partially covers Section 13.7.5.2.

* Evaluate C by dividing the cross section into separate rectangular parts and carrying out the summation.

Datum 13.7.5(d)	Source	Label	Number
Value of torsional stiffness used in the design.	X	K_{td}	
Required torsional stiffness of attached torsional member.	X	K_t	

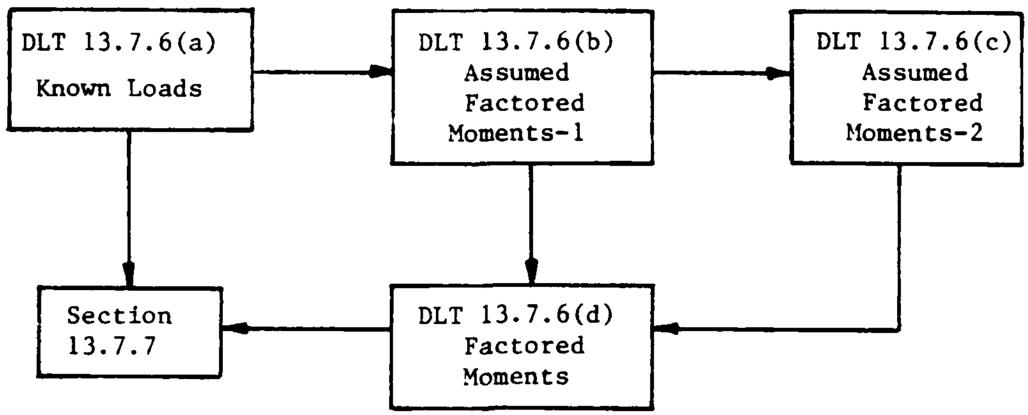
DLT 13.7.5(d) Torsional Stiffness - 2		1	2
C1	$K_{td} = K_t$?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT 13.7.6(a)	X	X

Comments:

1) DLT 13.7.5(d) partially covers Section 13.7.5.2.

2) The phraseology of 13.7.5.2 is such that the method of calculation, i.e., Eq (13.7), is the requirement rather than the value of K_t. It is assumed here that the value of K_t is the requirement to be checked.

Section 13.7.6 Map



Section 13.7.6 Arrangement of Live Load

Datum 13.7.6(a)	Source	Label	Number
If loading pattern is known.	X		
If equivalent frame analyzed for the known load.	X		

DLT 13.7.6(a) Known Loads		1	2	3
C1	Loading pattern known?	Y	Y	N
C2	Equivalent frame analyzed for known load?	Y	N	I
A1	Provision = satisfied	X		
A2	Provision ≠ satisfied		X	
A3	DLT 13.7.6(b)		X	X
A4	DLT 13.7.7(a)	X		

Comment: 1) DLT 13.7.6(a) covers Section 13.7.6.1.

Datum 13.7.6(b)	Source	Label	Number
If live load variable but does not exceed 3/4 of the dead load.	X		
If the nature of live load is such that all panels will be loaded simultaneously.	X		
If maximum moments assumed to occur at all sections with full factored live load on entire slab system.	X		

DLT 13.7.6(b) Assumed Factored Moments-1		1	2	3	4	5
C1	Live load variable but does not exceed 3/4 of the dead load?	Y	Y	N	N	N
C2	Nature of the live load is such that all panels will be loaded simultaneously?	Y	N	Y	N	N
C3	Maximum moments assumed to occur at all sections with full factored live load on entire slab system?	I	I	I	Y	N
A1	Provision = satisfied	X	X	X		X
A2	Provision ≠ satisfied				X	
A3	DLT 13.7.6(d)	X	X	X	X	
A4	DLT 13.7.6(c)					X

Comment: 1) DLT 13.7.6(b) covers Section 13.7.6.2.

Datum 13.7.6(c)	Source	Label	Number
If maximum positive factored moment near midspan of a panel assumed to occur with 3/4 the full factored live load on the panel and on alternate panels.	X		
If maximum negative factored moment in the slab at a support assumed to occur with 3/4 the full live load on adjacent panels only.	X		

DLT 13.7.6(c) Assumed Factored Moments - 2		1	2	3
C1	Maximum negative factored moment in the slab at a support assumed to occur with 3/4 the full live load on adjacent panels only.	Y	Y	N
C2	Maximum positive factored moment near midspan of a panel assumed to occur with 3/4 the full factored live load on the panel and on alternate panels?	Y	N	I
A1	Provision = satisfied	X		
A2	Provision ≠ satisfied		X	X
A3	DLT 13.7.6(d)	X	X	X

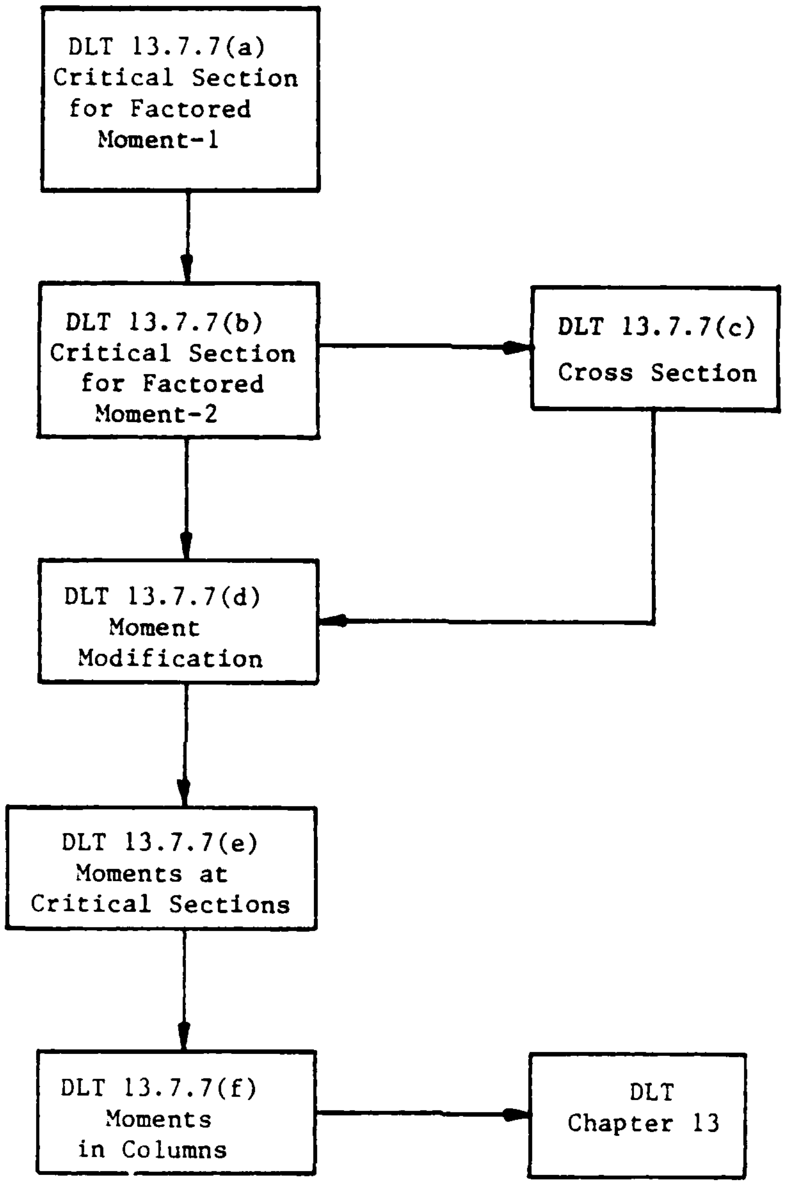
Comment: 1) DLT 13.7.6(c) covers Section 13.7.6.3.

Datum 13.7.6(d)	Source	Label	Number
If factored moments taken less than those occurring with full factored live load on all panels.	X		

DLT 13.7.6(d) Factored Moments		1	2
C1	Factored moments taken less than those occurring with full factored live load on all panels?	Y	N
A1	Provision = satisfied		X
A2	Provision ≠ satisfied	X	
A3	DLT 13.7.7(a)	X	X

Comment: 1) DLT 13.7.6(d) covers Section 13.7.6.4.

Section 13.7.7 Map



Section 13.7.7 Factored Moments

Datum 13.7.7(a)	Source	Label	Number
If interior support.	X		
If support type = rectilinear.	X		
If support type = column.	X		
If critical section for negative factored moment taken at face of support.	X		
If critical section for negative factored moment $\leq 0.175\ \ell_1$ from center.	X		

DLT 13.7.7(a)	Critical Section for Factored Moment-1	1	2	3	4	5	
C1	Interior support?	Y	Y	Y	Y	N	
C2	Support type = rectilinear?	Y	Y	N	N		E
C3	Support type = column?	N	N	Y	Y		L
C4	Critical section for negative factored moment taken at face of support?	Y	N				S
C5	Critical section for negative factored moment located $\leq 0.175\ \ell_1$ from center?			Y	N		E
A1	Provision = satisfied	X		X			
A2	Provision $\neq$ satisfied		X		X		
A3	DLT 13.7.7(b)						
A4	Logical Error					X	X

Comment: 1) DLT 13.7.7(a) covers Section 13.7.7.1.

Datum 13.7.7(b)	Source	Label	Number
If support is exterior and provided with brackets or capitals.	X		
If the location of the critical section for negative moment in the span perpendicular to the edge is less than 1/2 the projection of the bracket or capital beyond the face of the support,	X		

DLT 13.7.7(b)	Critical Section for Factored Moment-2	1	2	3
C1	Support = exterior and provided with brackets <u>or</u> capitals?	Y	Y	N
C2	Location of critical section for negative factored moment in the span perpendicular to the edge < 1/2 projection of bracket or capital beyond the face of the support?	Y	N	I
A1	Provision = satisfied	X		
A2	Provision ≠ satisfied		X	
A3	No Provision, DLT 13.7.7(d)			X
A4	DLT 13.7.7(c)	X	X	

Comment: 1) DLT 13.7.7(b) covers Section 13.7.7.2.

Datum 13.7.7(c)	Source	Label	Number
If cross-sectional shape of support is circular or regular polygon.	X		
If a non-rectangular shape is treated as a square of the same area for the location of the critical section for negative factored moment.	X		

DLT 13.7.7(c)	Cross Section	1	2	3
C1	Cross sectional shape of support = circular <u>or</u> regular polygon?	Y	Y	N
C2	Treated as square shape of the same area for the location of the critical section for negative design moment?	Y	N	I
A1	Provision = satisfied	X		
A2	Provision ≠ satisfied		X	
A3	No Provision			X
A4	DLT 13.7.7(d)	X	X	X

Comment: 1) DLT 13.7.7(c) covers Section 13.7.7.3.

Datum 13.7.7(d)	Source	Label	Number
If circular or regular polygon shaped supports treated as square supports with the same area for location of critical section for negative design moment.	X		
If slab system within the limitations of Section 13.6.1.	X		
If computed moments resulting from Equivalent Frame Method are reduced in such proportion that the absolute sum of the positive and average negative moments used in design need not exceed $(W_w \ell_2 \ell_n^2)/8$.	X		

DLT 13.7.7(d) Moment Modification		1	2	3
C1	Slab system within limitations of Section 13.6.1?	Y	N	N
C2	Computed moments resulting from Equivalent Frame Method analysis reduced in such proportion that the absolute sum of positive and average negative moments used in design need not exceed $(W_w \ell_2 \ell_n^2)/8$?	I	Y	N
A1	Provisions = satisfied	X		X
A2	Provisions ≠ satisfied		X	
A3	DLT 13.7.7(e)	X	X	X

Comment: 1) DLT 13.7.7(d) covers Section 13.7.7.4.

Datum 13.7.7(e)	Source	Label	Number
Modulus of elasticity of beam concrete.	X	E_{cb}	
Modulus of elasticity of slab concrete.	X	E_{cs}	
Moment of inertia about centroidal axis of gross cross section of beam as defined in Section 13.2.4.	X	I_b	
Moment of inertia about centroidal axis of gross section of slab.	X	I_s	
Length of span in direction that moments are being determined, measured center-to-center of supports.	X	ℓ_1	
Length of span transverse to ℓ_1, measured center-to-center of supports.	X	ℓ_2	
If moments at critical sections across the slab-beam strip of each frame distributed to column strips, beams, and middle strips as provided in Sections 13.6.4, 13.6.5, and 13.6.6?	X		

DLT 13.7.7(e)	Moments at Critical Sections	1	2	3
C1*	$2.0 \leq \dfrac{\alpha_1 \ell_2^2}{\alpha_2 \ell_1^2} \leq 5.0$?	Y	Y	N
C2	Moments at critical sections across the slab-beam strip of each frame distributed to column strips, beams, and middle strips as provided in Sections 13.6.4, 13.6.5, and 13.6.6?	Y	N	I
A1	Provision = satisfied	X		
A2	Provision ≠ satisfied		X	X
A3	DLT 13.7.7(f)	X	X	X

Comment:

1) DLT 13.7.7(e) covers Section 13.7.7.5.

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* $\alpha = \dfrac{E_{cb} I_b}{E_{cs} I_s}$; $\alpha_1 = \alpha$ in direction of ℓ_1 ; $\alpha_2 = \alpha$ in direction ℓ_2 .

Datum 13.7.7(f)	Source	Label	Number
If moments determined for the equivalent columns in the frame analysis used in design of the actual columns above and below the slab beams.	X		

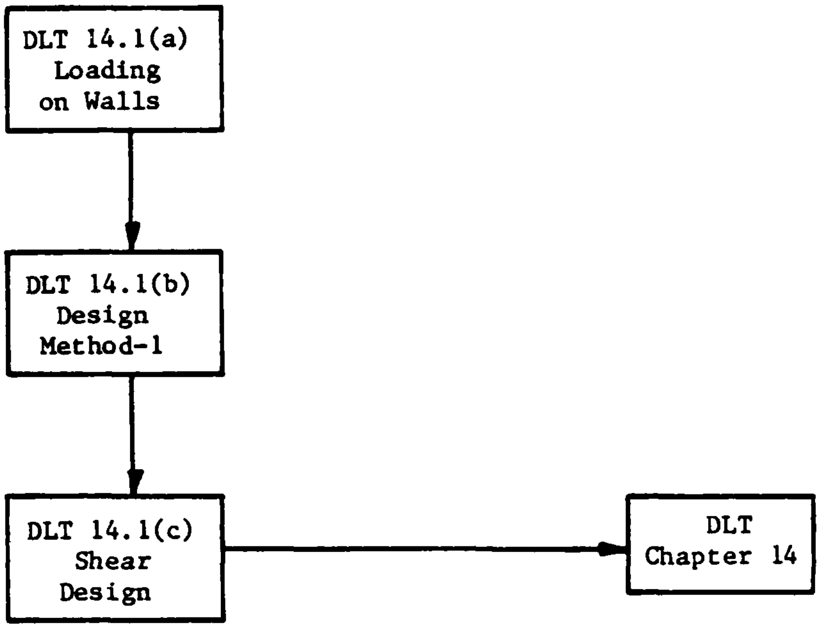
DLT 13.7.7(f) Moments in Columns		1	2
C1	Moments determined for the equivalent columns in the frame analysis used in design of the actual columns above and below the slab beams?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT Ch. 13	X	X

Comment: 1) DLT 13.7.7(e) covers Section 13.7.7.6.

ACI CHAPTER 14: WALLS

DLT Chapter 14		1	2	3	4	
C1	Structural Design?	Y	N	N	N	ELSE
C2	Empirical Design Method?	N	Y	N	N	
C3	Walls as Grade Beams?	N	N	Y	N	
A1	Section 14.1	X				
A2	Section 14.2		X			
A3	Section 14.3			X		
A4	DLT 318-77 Index				X	
A5	Logical Error					X

Section 14.1 Map



Section 14.1 Structural Design

Datum 14.1(a)	Source	Label	Number
If walls designed for any lateral or other loads to which they are subjected.	X		
If proper provisions made for eccentric loads and lateral forces.	X		

DLT 14.1(a) Loading on Walls		1	2	3
C1	Walls designed for any lateral or other loads to which they are subjected?	Y	Y	N
C2	Proper provisions made for eccentric loads and lateral forces?	Y	N	I
A1	Provision = satisfied	X		
A2	Provision ≠ satisfied		X	X
A3	DLT 14.1(b)	X	X	X

Comment: 1) DLT 14.1(a) covers Sections 14.1.1 and 14.1.2.

Datum 14.1(b)	Source	Label	Number
If wall is subject to combined flexure and axial loads.	X		
If empirical design method of Section 14.2 used.	X		
If wall is designed under the provisions of Section 10.15.	X		

DLT 14.1(b)	Design Method	1	2	3	4	5	6	
C1	Wall subject to combined flexure and axial loads?	Y	Y	Y	N	N	N	E
								L
C2	Empirical design method of Section 14.2 used?	Y	N	N	Y	N	N	S
C3	Wall designed under the provisions of Section 10.15?	N	Y	N	N	Y	N	E
A1	Provisions = satisfied	X	X				X	
A2	Provisions ≠ satisfied			X	X	X		
A3	DLT 14.1(c)	X	X	X	X	X	X	
A4	Logical Error							X

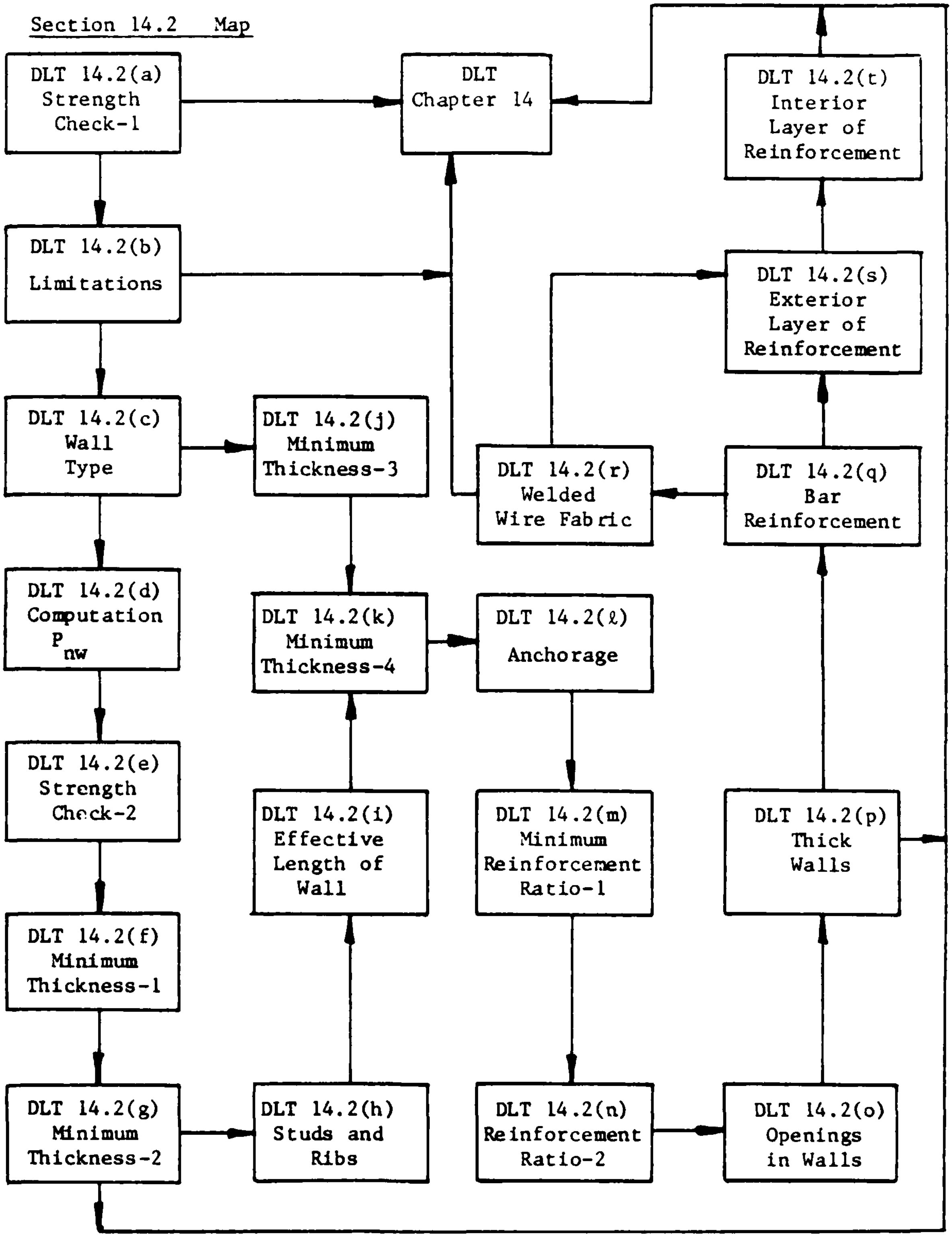
Comment: 1) DLT 14.1(b) covers Section 14.1.3.

Datum 14.1(c)	Source	Label	Number
It design for shear in accordance with Section 11.10.	X		

DLT 14.1(c)	Shear Design	1	2
C1	Design for shear in accordance with Section 11.10?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT Ch. 14	X	X

Comment: 1) DLT 14.1(c) covers Section 14.1.4.

Section 14.2 Map



Section 14.2 Empirical Design Method

Datum 14.2(a)	Source	Label	Number
If structural analysis of wall shows adequate strength and stability.	X		

DLT 14.2(a) Strength Check - 1		1	2
C1	Structural analysis of wall shows adequate strength and stability?	Y	N
A1	Provision = satisfied	X	
A2	DLT 14.2(b)		X
A3	DLT Ch. 14	X	

Comment: 1) DLT 14.2(a) covers Section 14.2.2.

Datum 14.2(b)	Source	Label	Number
If wall is of solid rectangular cross section.	X		
If the resultant of all factored loads located within the middle third of the overall thickness of wall.	X		

DLT 14.2(b) Limitations		1	2	3
C1	Wall has solid rectangular cross section?	Y	Y	N
C2	Resultant of all factored loads located within middle third of overall thickness of wall?	Y	N	I
A1	Provisions of Section 14.2 apply	X		
A2	Provisions of Section 14.2 do not apply		X	X
A3	DLT 14.2(c)	X		
A4	DLT Ch. 14		X	X

Comment: 1) DLT 14.2(b) covers Section 14.2.1.

Datum 14.2(c)	Source	Label	Number
If the wall is a bearing wall.	X		
Unsupported height.	X	UH	
Unsupported width.	X	UW	

DLT 14.2(c) Wall Type		1	2
C1	Wall = bearing wall?	Y	N
A1	TM = min[1/25(UH,UW)]	X	
A2	DLT 14.2(d)	X	
A3	DLT 14.2(j)		X

Comments: 1) DLT 14.2(c) is a switching DLT and covers Section 14.2.5.

2) Sections 14.2.5, 14.2.6, and 14.2.14 specifically address "bearing walls" and Section 14.2.8 specifically addresses "non-bearing walls". The other sections of this chapter do not contain such specific references. Sections 14.2.3, 14.2.4 are assumed to apply to "bearing walls" also. Other sections are assumed to apply to both.

Datum 14.2(d)	Source	Label	Number
Specified compressive strength of concrete, psi.	X	f'_c	
Vertical distance between supports.	X	ℓ_c	
Overall thickness of member.	X	h	
Gross area of section.	X	A_g	
If wall is braced against lateral translation.	X		
If wall is restrained against rotation at one or both ends (top and/or bottom).	X		

DLT 14.2(d)	Computation of P_{nw}	1	2	3
C1	Wall braced against lateral translation?	Y	Y	N
C2	Wall restrained against rotation at one or both ends (top and/or bottom)?	Y	N	I
A1	$P_{nw} = 0.55\ f'_c A_g \left[1 - \left(\frac{\ell_c}{40\ h}\right)^2\right]$	X		
A2	$P_{nw} = 0.55\ f'_c A_g \left[1 - \left(\frac{\ell_c}{32\ h}\right)^2\right]$		X	
A3	$P_{nw} = 0.55\ f'_c A_g \left[1 - \left(\frac{\ell_c}{16\ h}\right)^2\right]$			X
A4	DLT 14.2(e)	X	X	X

Comments:

1) DLT 14.2(d) is a working DLT that partially covers Section 14.2.3.

2) Provisions for the effective length factor, k, are written into the formulation of P_{nw} according to conditions C1 and C2.

Datum 14.2(e)	Source	Label	Number
Nominal axial load strength of wall.	DLT 14.2(c)	P_{nw}	
Factored axial load on wall.	X	P_u	

DLT 14.2(e) Strength Check - 2		1	2
C1	$0.70\ P_{nw} \geq P_u$?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT 14.2(f)	X	X

Comment: 1) DLT 14.2(e) partially covers Section 14.2.3.

Datum 14.2(f)	Source	Label	Number
If two story dwelling.	X		
If considering uppermost 15 ft of wall height.	X		
Minimum thickness.	DLT 14.2(e)	TM_i	
Number of 25 foot heights of wall (or fraction thereof) below uppermost 15 ft.	X	n	
Number of height segment being checked where i = 2 for the first 25 ft segment below the top 15 ft.	X	i	

DLT 14.2(f) Minimum Thickness - 1		1	2	3
C1	One or two-story dwelling?	Y	N	N
C2	Considering uppermost 15 ft?	I	Y	N
A1	$TM_1 = \max[TM,6]$, set $i = 1$	X	X	
A2	$TM_i = \sum_{i=2}^{n+1} (TM_1 + i-1)$			X
A3	DLT 14.2(g)	X	X	X

Comments: 1) DLT 14.2(f) covers partially Section 14.2.6.

2) Minimum wall thickness for succeeding 25 ft downward is assumed to 1 in. greater than height above rather than for the minimum above the section under consideration.

3) It is assumed that the provision of Section 14.2.5 (TM) must also be considered for two-story buildings and the uppermost 15 ft of wall height.

4) It is assumed that provisions for two-story buildings apply also to one-story buildings.

5) The use of "story" to describe or imply height relies on an unstated assumption of the magnitude of story height. A dimensional description would be more precise.

Datum 14.2 (g)	Source	Label	Number
Thickness of the ith segment of wall where i = 1 refers to the top 15 ft and i = 2, 3, ... refers to each 25 ft segment (or fraction thereof) below.	X	h_i	
Minimum thicknesses below uppermost 15 ft.	DLT 14.2(f)	TM_i	

DLT 14.2(g) Minimum Thickness - 2		1	2
C1	$h_{(i)} \geq TM_{(i)}$	Y	N
A1	Provisions = satisfied	X	
A2	Provisions ≠ satisfied		X
A3	DLT 14.2(h)	X	
A4	DLT Ch. 14		X

Comments: 1) DLT 14.2(g) partially covers Section 14.2.6.

2) It is assumed that in the case of two-story buildings the thickness below the top 15 ft of wall will be equal to or greater than that of the top 15 ft.

Datum 14.2(h)	Source	Label	Number
If the bearing wall consists of studs or ribs tied together by other reinforced concrete members at each floor or roof level.	X		
If studs or ribs considered as columns.	X		

DLT 14.2(h)	Studs and Ribs	1	2
C1	Bearing wall consists of studs or ribs tied together by other reinforced concrete members at each floor or roof level?	Y	N
C2	Studs or ribs considered as columns?	I	I
A1	Provisions = satisfied	X	
A2	DLT 14.2(i)	X	X

Comment: 1) DLT 14.2(h) covers Section 14.2.14.

Datum 14.2(i)	Source	Label	Number
Horizontal length of wall considered as effective for each concentrated load or reaction.	X	DEF	
Center-to-center distance between loads.	X	DBL	
Width of bearing.	X	BW	
Overall thickness of wall.	X	h	

DLT 14.2(i)	Effective Length of Wall	1	2
C1	DEF $\leq$ min[DBL, (BW + 4h)]?	Y	N
A1	Provisions = satisfied	X	
A2	Provisions $\neq$ satisfied		X
A3	DLT 14.2(k)	X	

Comments) 1) DLT 14.2(i) covers Section 14.2.4.

2) Section 14.2.4 is assumed to apply to "bearing walls".

Datum 14.2(j)	Source	Label	Number
Overall thickness of wall, in.	X	h	
Distance between supporting or enclosing members.	X	DB	

DLT 14.2(j) Minimum Thickness - 3		1	2
C1	$h \geq \max[4, DB/30]$?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT 14.2(k)	X	X

Comment: 1) DLT 14.2(j) covers Section 14.2.8.

Datum 14.2(k)	Source	Label	Number
If exterior basement walls, foundation walls, fire walls or party walls.	X		
Overall thickness of member, in.	X	h	

DLT 14.2(k) Minimum Thickness - 4		1	2	3
C1	Wall = exterior basement, foundation, fire or party wall?	Y	Y	N
C2	h $\geq$ 8?	Y	N	I
A1	Provision = satisfied	X		
A2	Provision $\neq$ satisfied		X	
A3	DLT 14.2(ℓ)	X	X	X

Comment: 1) DLT 14.2(k) covers Section 14.2.7.

Datum 14.2(ℓ)	Source	Label	Number
If wall anchored to floors, roofs, or to columns, pilasters, buttresses, or intersecting walls.	X		

DLT 14.2(ℓ) Anchorage		1	2
C1	Wall anchored to floors, roofs, columns, pilasters, buttresses, or intersecting walls?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT 14.2(m)	X	X

Comment:

1) DLT 14.2(ℓ) covers Section 14.2.9.

Datum 14.2(m)	Source	Label	Number
Specified yield strength of reinforcement.	X	f_y	
Reinforcing bar or wire size.	X		

DLT 14.2(m)	Minimum Reinforcement Ratio - 1	1	2	3
C1	$f_y \geq 60000$?	Y	Y	N
C2	Reinforcement size $\leq$ #5 bar or wire $\leq$ W31,D31?	Y	N	I
A1	$\rho_h = 0.0020$	X		
A2	$\rho_v = 0.0012$	X		
A3	$\rho_h = 0.0025$		X	X
A4	$\rho_v = 0.0015$		X	X
A5	DLT 14.2(n)	X	X	X

Comment: 1) DLT 14.2(m) partially covers Sections 14.2.10 and 14.2.11.

Datum 14.2(n)	Source	Label	Number
Area of horizontal reinforcement.	X	A_h	
Area of vertical reinforcement.	X	A_v	
Gross area of section, sq in.	X	A_g	
Minimum horizontal reinforcement ratio.	DLT 14.2(m)	ρ_h	
Minimum vertical reinforcement ratio.	DLT 14.2(m)	ρ_v	

DLT 14.2(n) Reinforcement Ratio - 2		1	2	3
C1	$A_h \geq A_g \rho_h$?	Y	Y	N
C2	$A_v \geq A_g \rho_v$?	Y	N	I
A1	Provision = satisfied	X		
A2	Provision ≠ satisfied		X	X
A3	DLT 14.2(o)	X	X	X

Comment: 1) DLT 14.2(n) covers Sections 14.2.10 and 14.2.11.

Datum 14.2(o)	Source	Label	Number
If (window or door) openings in wall.	X		
If at least two #5 bars provided around opening.	X		
If bars extend at least 24 in. beyond corner of openings.	X		

DLT 14.2(o)	Openings in Walls	1	2	3	4	
C1	(Window or door) openings in walls?	Y	Y	Y	N	E
C2	At least two #5 bars provided around opening?	Y	Y	N		L
						S
C3	Bars extend at least 24 in. beyond corners of openings?	Y	N	I		E
A1	Provision = satisfied	X				
A2	Provision ≠ satisfied		X	X		
A3	DLT 14.2(p)	X	X	X	X	
A4	Logical Error					X

Comment: 1) DLT 14.2(o) covers Section 14.2.13.

Datum 14.2(p)	Source	Label	Number
Overall thickness of member, in.	X	h	
If reinforcement in each direction placed in two layers parallel with faces of wall.	X		

DLT 14.2(p) Thick Walls		1	2	3
C1	h > 10 in.?	Y	Y	N
C2	Reinforcement in each direction placed in two layers parallel with faces of wall?	Y	N	I
A1	Provision = satisfied	X		
A2	Provision ≠ satisfied		X	
A3	DLT 14.2(q)	X		
A4	DLT Ch. 14		X	X

Comment: 1) DLT 14.2(p) partially covers Section 14.2.12.

Datum 14.2(q)	Source	Label	Number
If bars used as reinforcement.	X		
Bar size.	X		
Spacing between bars (o/c).	X	s	

DLT 14.2(q) Bar Reinforcement		1	2	3	4
C1	Bars used as reinforcement?	Y	Y	Y	N
C2	Bar size $\geq$ #3?	Y	Y	N	I
C3	s $\leq$ 18 in.?	Y	N	I	I
A1	Provisions = satisfied	X			
A2	Provisions $\neq$ satisfied		X	X	
A3	DLT 14.2(r)				X
A4	DLT 14.2(s)	X	X	X	

Comment: 1) DLT 14.2(q) partially covers Section 14.2.12(c).

Datum 14.2(r)	Source	Label	Number
If welded wire fabric used.	X		
If welded wire fabric in flat sheet form.	X		

DLT 14.2(r)	Weld Wire Fabric	1	2	3
C1	Welded wire fabric used as reinforcement?	Y	Y	N
C2	Welded wire fabric in flat sheet form?	Y	N	I
A1	Provision = satisfied	X		
A2	Provision ≠ satisfied		X	
A3	DLT 14.2(s)	X	X	
A4	No Provision			X
A5	DLT Ch. 14			X

Comment: 1) DLT 14.2(r) partially covers Section 14.2.12(c).

Datum 14.2(s)	Source	Label	Number
Gross area of section, sq in.	X	A_g	
Reinforcement ratio (horizontal).	DLT 14.2(m)	ρ_h	
Reinforcement ratio (vertical).	DLT 14.2(m)	ρ_v	
Distance from external face to reinforcement layer (horizontal).	X	DE_h	
Distance from external face to reinforcement layer (vertical).	X	DE_v	
Area of steel in exterior layer (horizontal).	X	A_{he}	
Area of steel in exterior layer (vertical).	X	A_{ve}	
Overall thickness of wall.	X	h	

DLT 14.2(s)	Exterior Layer of Reinforcement	1	2	3	4
C1	$\frac{2}{3} A_g \rho_v \geq A_{ve} \geq \frac{1}{2} A_g \rho_v$?	Y	Y	Y	N
C2	$\frac{2}{3} A_g \rho_h \geq A_{he} \geq \frac{1}{2} A_g \rho_v$?	Y	Y	N	I
C3	$\frac{h}{3} \geq (DE_h \text{ and } DE_v) \geq 2$ in.?	Y	N	I	I
A1	Provisions = satisfied	X			
A2	Provisions ≠ satisfied		X	X	X
A3	DLT 14.2(t)	X	X	X	X

Comment:

1) DLT 14.2(s) covers Section 14.2.12(a).

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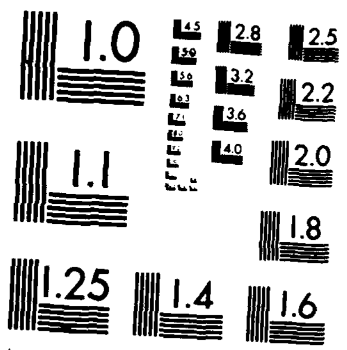

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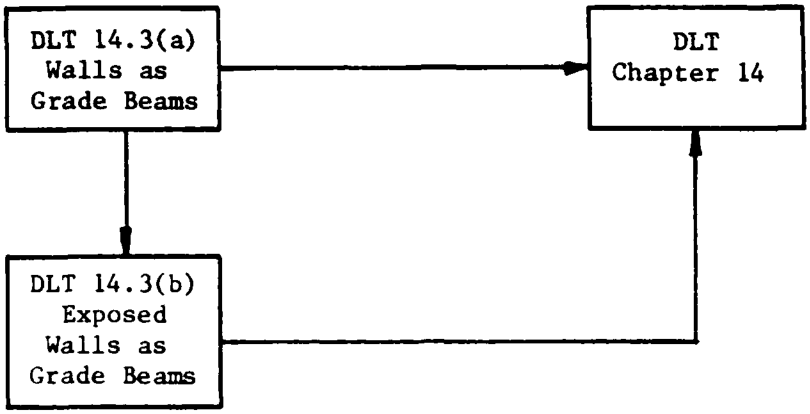
Datum 14.2(t)	Source	Label	Number
Gross area of section, sq in.	X	A_g	
Reinforcement ratio (horizontal).	X	ρ_h	
Reinforcement ratio (vertical).	X	ρ_v	
Area of steel in exterior layer (horizontal).	X	A_{he}	
Area of steel in exterior layer (vertical).	X	A_{ve}	
Area of steel in interior layer (horizontal).	X	A_{hi}	
Area of steel in interior layer (vertical).	X	A_{vi}	
Distance from internal face to reinforcement layer (horizontal).	X	DI_h	
Distance from internal face to reinforcement layer (vertical).	X	DI_v	
Overall thickness of member, in.	X	h	

DLT 14.2(t)	Interior Layer of Reinforcement	1	2	3	4
C1	$A_{vi} \geq (\rho_v A_g - A_{ve})$?	Y	Y	Y	N
C2	$A_{hi} \geq (\rho_h A_g - A_{he})$?	Y	Y	N	I
C3	$\frac{h}{3} \geq (DI_h \text{ and } DI_v) \geq \frac{3}{4}$ in.?	Y	N	I	I
A1	Provisions = satisfied	X			
A2	Provisions ≠ satisfied		X	X	X
A3	DLT Chapter 14	X	X	X	X

Comment:

1) DLT 14.2(t) covers Section 14.2.12(b).

Section 14.3 Map



Section 14.3 Walls as Grade Beams

Datum 14.3(a)	Source	Label	Number
If wall used as grade beam.	X		
If top and bottom reinforcement as required for moment in accordance with provisions of Sections 10.2 through 10.7.	X		
If shear design in accordance with provisions of Chapter 11.	X		

DLT 14.3(a)	Wall as Grade Beam	1	2	3	4
C1	Wall used as grade beam?	Y	Y	Y	N
C2	Top and bottom reinforcement as required for moment in accordance with provisions of Sections 10.2 through 10.7?	Y	Y	N	I
C3	Shear design in accordance with provisions of Chapter 11?	Y	N	I	I
A1	Provision = satisfied	X			
A2	Provision ≠ satisfied		X	X	
A3	DLT 14.3(b)	X	X	X	
A4	DLT Ch. 14				X

Comment: 1) DLT 14.3(a) covers Section 14.3.1.

Datum 14.3(b)	Source	Label	Number
If portions of grade beam walls exposed above grade.	X		
If exposed beams meet requirements of Section 10.15 or Section 14.2.	X		

DLT 14.3(b)	Exposed Walls as Grade Beams	1	2	3
C1	Portions of grade beam walls exposed above grade?	Y	Y	N
C2	Exposed beams meet requirements of Section 10.15 or Section 14.2?	Y	N	I
A1	Provision = satisfied	X		
A2	Provision ≠ satisfied		X	
A3	DLT Ch. 14	X	X	X

Comment: 1) DLT 14.3(b) covers Section 14.3.2.

ACI CHAPTER 15: FOOTINGS

DLT Chapter 15.1		1	2	3	4	5	6	7	
C1	Scope?	Y	N	N	N	N	N	N	
C2	Loads and reactions?	N	Y	N	N	N	N	N	E
C3	Footings supporting circular or regular polygon shaped columns or pedestals?	N	N	Y	N	N	N	N	L S
C4	Moment in footings?	N	N	N	Y	N	N	N	E
C5	Shear in footings?	N	N	N	N	Y	N	N	
C6	Development of reinforcement in footings?	N	N	N	N	N	Y	N	
A1	Section 15.1	X							
A2	Section 15.2		X						
A3	Section 15.3			X					
A4	Section 15.4				X				
A5	Section 15.5					X			
A6	Section 15.6						X		
A7	DLT Chapter 15-2							X	
A8	Logical Error								X

DLT Chapter 15-2		1	2	3	4	5	6	
C1	Minimum footing depth?	Y	N	N	N	N	N	E
C2	Transfer of force at base of column or reinforced pedestal?	N	Y	N	N	N	N	L
								S
C3	Sloped or stepped footings?	N	N	Y	N	N	N	E
C4	Combined footings and mats?	N	N	N	Y	N	N	
C5	Plain concrete pedestals and footings?	N	N	N	N	Y	N	
A1	Section 15.7	X						
A2	Section 15.8		X					
A3	Section 15.9			X				
A4	Section 15.10				X			
A5	Section 15.11					X		
A6	DLT 318-77 Index						X	
A7	Logical Error							X

Section 15.1 Scope

Datum 15.1(a)	Source	Label	Number
If element = isolated footing, combined footing, or mat, or unreinforced pedestal.	X		
If design based on provisions of Chapter 15.	X		

DLT 15.1(a) Scope		1	2	3
C1	Element = isolated footing, combined footing, or mat, or unreinforced pedestal?	Y	Y	N
C2	Design based on provisions of Chapter 15?	Y	N	I
A1	Provision = satisfied	X		
A2	Provision ≠ satisfied		X	X
A3	DLT Ch. 15	X	X	X

Comments:

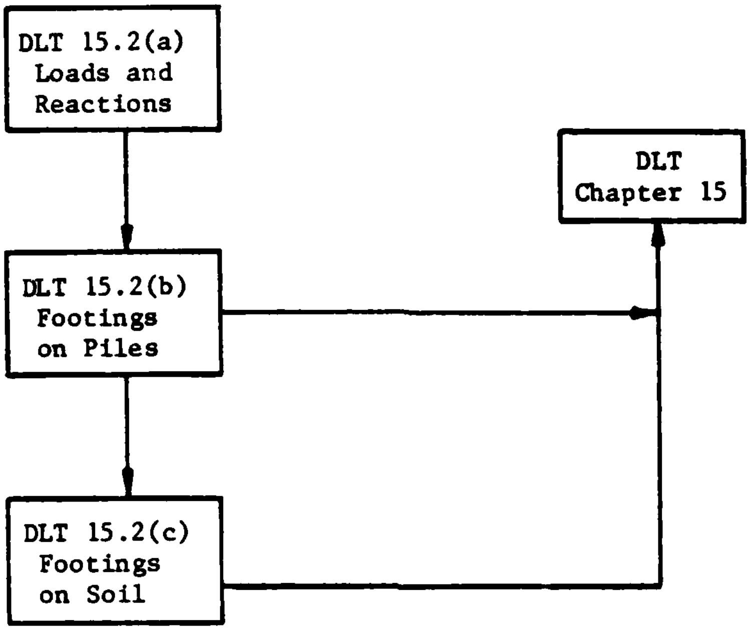
1) DLT 15.1(a) covers Section 15.1.

2) The scope as stated is incomplete because plain concrete pedestals are covered in Section 15.11.

3) A pedestal apparently may be supported by a footing (Section 15.3) or be a footing (Section 15.11).

4) As stated, Section 15.1 requires a user to decide which provisions other than those of 15.10 apply to combined footings and mats. However, it is assumed that all Sections apply to combined footings and mats <u>except</u> Section 15.4.2 which specifically states "isolated footing," Section 15.5.2 which refers to footings supporting <u>a</u> column, pedestal or wall, and the first part of Section 15.6.3 which refers to Section 15.4.2.

Section 15.2 Map



Section 15.2 Loads and Reactions

Datum 15.2(a)	Source	Label	Number
If footings proportioned to resist the factored loads and induced reactions.	X		

DLT 15.2(a)	Loads and Reactions	1	2
C1	Footings proportioned to resist the factored loads and induced reactions in accordance with the Code?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT 15.2(b)	X	X

Comment: 1) DLT 15.2(a) covers Section 15.2.1.

Datum 15.2(b)	Source	Label	Number
If footing is supported by piles.	X		
If the number and arrangement of piles was determined from the external forces and moments* (transmitted by footing to piles) and pile capacity selected through principles of soil mechanics.	X		
If computations for footing moments and shears were the assumption that the reaction from any pile is concentrated at the pile center.	X		

DLT 15.2(b) Footings on Piles		1	2	3	
C1	Footing supported by piles?	Y	Y	N	E
C2	Number and arrangement of piles determined from the external forces and moments (transmitted by footing to piles) and pile capacity selected through principles of soil mechanics?	Y	N		L S E
C3	Computations for footing moments and shears based on assumption that the reaction from any pile is concentrated at the pile center?	I	I		
A1	Provisions = satisfied	X			
A2	Provisions ≠ satisfied		X		
A3	DLT 15.2(c)			X	
A4	DLT Chapter 15	X	X		
A5	Logical Error				X

Comment

1) DLT 15.2(b) covers Sections 15.2.3 and 15.2.4.

---

* External forces and moments are those resulting from unfactored loads (D, L, W, and E) specified in the general building code of which these requirements form a part.

Datum 15.2(c)	Source	Label	Number
If external forces or moments* transferred to supporting soil without exceeding permissible soil pressures.	X		
If base area of footing determined from the external forces and moments (transmitted by footing to soil) and permissible soil pressure selected through principles of soil mechanics.	X		

DLT 15.2(c)	Footing on Soil	1	2	3
C1	External forces and moments transferred to supporting soil without exceeding permissible soil pressures?	Y	Y	N
C2	Base area of footing determined from the external forces and moments (transmitted by footing to soil) and permissible soil pressure selected through principles of soil mechanics?	Y	N	I
A1	Provision = satisfied	X		
A2	Provision ≠ satisfied		X	X
A3	DLT Chapter 15	X	X	X

Comment:

1) DLT 15.2(c) covers Sections 15.2.2 and 15.2.4.

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* External forces and moments are those resulting from unfactored loads (D, L, W, and E) specified in the general building code of which these requirements form a part.

Section 15.3 Map

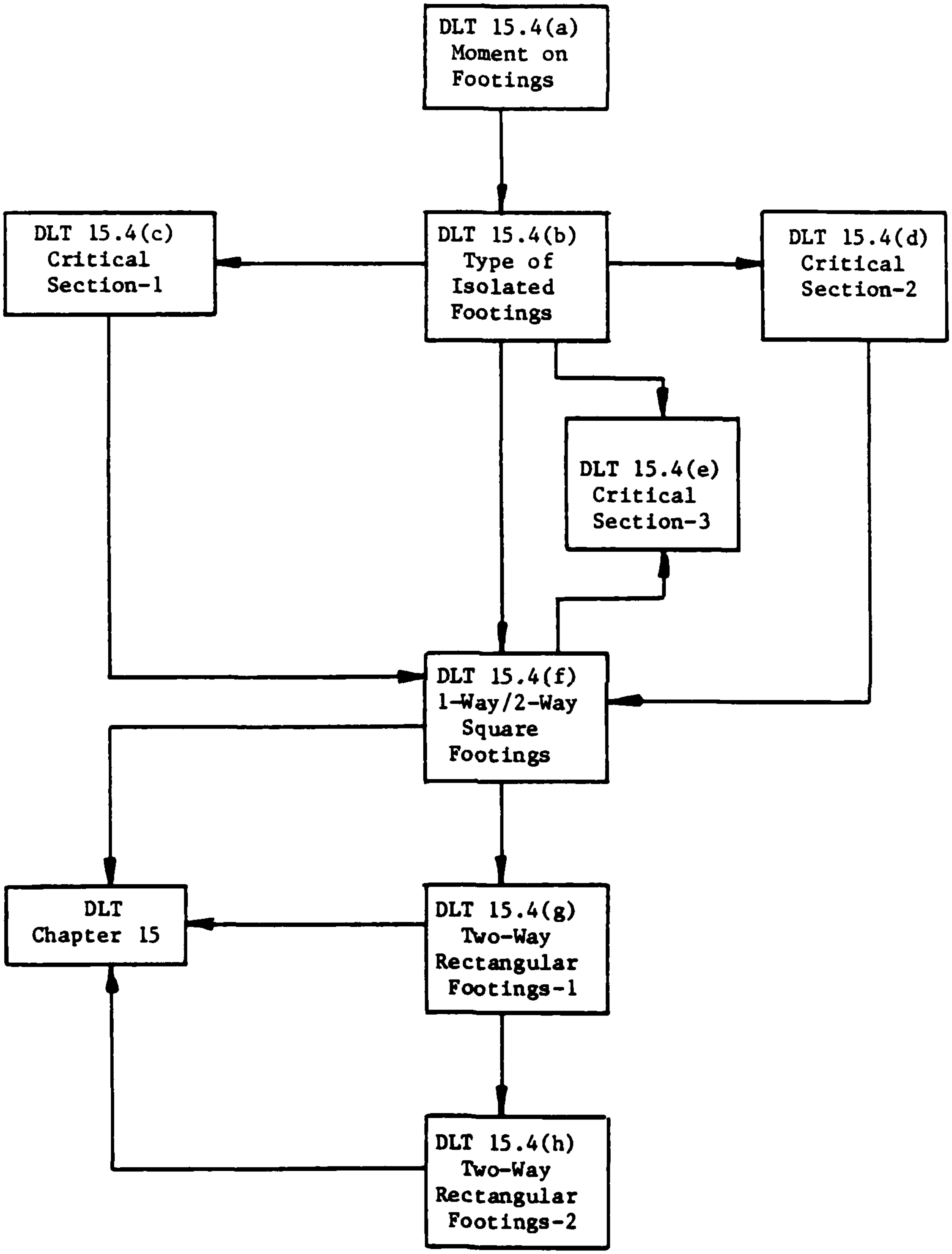
Section 15.3 Footings Supporting Circular or Regular Polygon Shaped Columns or Pedestals

Datum 15.3(a)	Source	Label	Number
If circular or regular polygon shaped concrete columns or pedestals treated as square members with the same area for location of critical sections for moment, shear, and development of reinforcement in footings.	X		

DLT 15.3(a) Circular or Regular Polygon Shapes		1
C1	Circular or regular shaped concrete columns or pedestals treated as square members with the same area for location of critical sections for moment, shear, and development of reinforcement in footings?	I
A1	Provision = satisfied	X
A2	DLT Chapter 15	X

Comment: 1) DLT 15.3(a) covers Section 15.3.

Section 15.4 Map



Section 15.4 Moment in Footings

Datum 15.4(a)	Source	Label	Number
If external moment on any section of a footing determined by passing a vertical plane through the footing.	X		
If external moment = moment of footings acting on entire area of the footing on one side of the vertical plane.	X		

DLT 15.4(a)	Moment in Footings	1	2	3
C1	External moment on any section of a footing determined by passing a vertical plane through the footing?	Y	Y	N
C2	External moment = moment of footings acting on entire area of footings on one side of the vertical plane?	Y	N	I
A1	Provision = satisfied	X		
A2	Provision ≠ satisfied		X	X
A3	DLT 15.4(b)	X	X	X

Comment: 1) DLT 15.4(a) covers Section 15.4.1.

Datum 15.4(b)	Source	Label	Number
If footing is an isolated footing supporting a concrete column, pedestal, or wall.	X		
If footing is an isolated footing supporting a masonry wall.	X		
If footing is an isolated footing supporting a column with steel base plates.	X		

DLT 15.4(b) Type of Isolated Footing		1	2	3	4	
C1	Footing = isolated footing supporting a concrete column, pedestal, or wall?	Y	N	N	N	E
						L
C2	Footing = isolated footing supporting a masonry wall?	N	Y	N	N	S
C3	Footing = isolated footing supporting a column with steel base plates?	N	N	Y	N	E
A1	DLT 15.4(c)	X				
A2	DLT 15.4(d)		X			
A3	DLT 15.4(e)			X		
A4	DLT 15.4(f)				X	
A5	Logical Error					X

Comment: 1) DLT 15.4(b) is a switching DLT for Section 15.4.2.

Datum 15.4(c)	Source	Label	Number
If maximum factored moment computed at face of column, pedestal, or wall.	X		

DLT 15.4(c)	Critical Section - 1	1	2
C1	Maximum factored moment computed at face of column, pedestal, or wall?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT 15.4(f)	X	X

Comment: 1) DLT 15.4(c) covers Section 15.4.2(a).

Datum 15.4(d)	Source	Label	Number
If maximum factored moment computed halfway between middle and edge of wall.	X		

DLT 15.4(d) Critical Section - 2		1	2
C1	Maximum factored moment computed halfway between middle and edge of wall?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT 15.4(f)	X	X

Comment: 1) DLT 15.4(d) covers Section 15.4.2(b).

Datum 15.4(e)	Source	Label	Number
If maximum factored moment computed half-way between face of the column and the edge of the steel base.	X		

DLT 15.4(e) Critical Section - 3		1	2
C1	Maximum factored moment computed halfway between face of the column and the edge of the steel base plates?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT 15.4(f)	X	X

Comment: 1) DLT 15.4(e) covers Section 15.4.2(c).

Datum 15.4(f)	Source	Label	Number
If footing is a one-way footing or a two-way square footing.	X		
If footing is a two-way rectangular footing.	X		
If reinforcement distributed uniformly across entire width of footing.	X		

DLT 15.4(f)	1-Way/2-Way Square Footings	1	2	3	4	
C1	Footing = one-way footing or two-way square footing?	Y	Y	N	N	E L S E
C2	Footing = two-way rectangular footing?	N	N	Y	N	
C3	Reinforcement distributed uniformly across entire width of footing?	Y	N			
A1	Provisions = satisfied	X				
A2	Provisions ≠ satisfied		X			
A3	DLT 15.4(g)			X		
A4	No Provision				X	
A5	DLT Ch. 15	X	X		X	
A6	Logical Error					X

Comment: 1) DLT 15.4(f) covers Section 15.4.3.

Datum 15.4(g)	Source	Label	Number
If reinforcement in long direction distributed uniformly across entire width of footing.	X		
Total area of reinforcement required in short direction, sq in.	X	A_T	
Area of reinforcement in short direction located within bandwidth equal to short side length centered on column or pedestal.	X	A_{BW}	
Ratio of long side to short side of footing.	X	β	

DLT 15.4(g) Two-Way Rectangular Footings - 1		1	2	3
C1	Reinforcement in long direction distributed uniformly across entire width of footing?	Y	Y	N
C2	$A_{BW} = 2/(\beta+1) \cdot A_T$?	Y	N	I
A1	Provision = satisfied	X		
A2	Provision $\neq$ satisfied		X	X
A3	DLT 15.4(h)	X	X	X

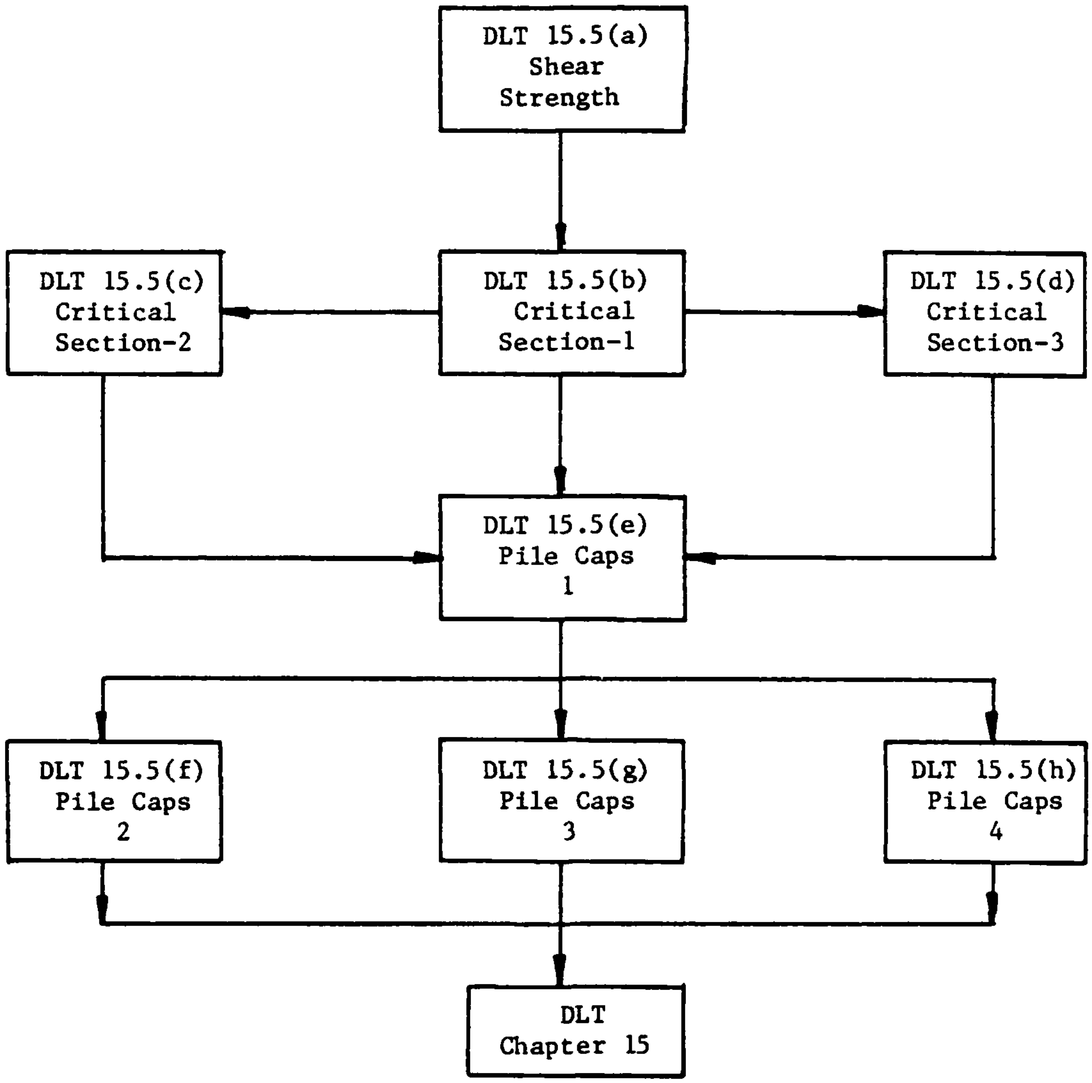
Comment: 1) DLT 15.4(g) partially covers Section 15.4.4.

Datum 15.4(h)	Source	Label	Number
If short side reinforcement located within bandwidth distributed uniformly over the bandwidth.	X		
If remainder of reinforcement required in short direction, ($A_T - A_{BW}$), distributed uniformly outside center bandwidth of footing.	X		

DLT 15.4(h) Two-Way Rectangular Footings - 2		1	2	3
C1	Short side reinforcement, located within bandwidth, distributed uniformly within bandwidth?	Y	Y	N
C3	Remainder of reinforcement required in short direction, ($A_T - A_{BW}$), distributed uniformly outside center bandwidth?	Y	N	I
A1	Provision = satisfied	X		
A2	Provision ≠ satisfied		X	X
A3	DLT Ch. 15	X	X	X

Comment: 1) DLT 15.4(h) partially covers Section 15.4.4.

Section 15.5 - Map



Section 15.5 Shear in Footings

Datum 15.5(a)	Source	Label	Number
If shear strength in footings determined according to Section 11.11.	X		

DLT 15.5(a)	Shear Strength	1	2
C1	Shear strength in footings determined according to Section 11.11?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT 15.5(b)	X	X

Comments:

1) DLT 15.5(a) covers Section 15.5.1.

2) The Code refers to "computation of shear" in Section 15.5.1 whereas the Commentary refers to the computation of shear strength. Wording of the Commentary is used because it appears to be more appropriate.

Datum 15.5(b)	Source	Label	Number
If footing supporting a column, pedestal, or wall (w/o steel base plates).	X		
If footing supporting a column or pedestal with steel base plates.	X		

DLT 15.5(b) Critical Section - 1		1	2	3	
C1	Footing supports a column, a pedestal, or a wall (w/o steel base plates)?	Y	N	N	ELSE
C2	Footing supports a column or pedestal with steel base plates?	N	Y	N	
A1	DLT 15.5(c)	X			
A2	DLT 15.5(d)		X		
A3	DLT 15.5(e)			X	
A4	Logical Error				X

Comment: 1) DLT 15.5(b) partially covers Section 15.5.2.

Datum 15.5(c)	Source	Label	Number
If critical section for shear measured from face of column, pedestal, or wall.	X		

DLT 15.5(c) Critical Section - 2		1	2
C1	Critical section for shear measured from face of column, pedestal, or wall?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT 15.5(e)	X	X

Comment: 1) DLT 15.5(c) partially covers Section 15.5.2.

Datum 15.5(d)	Source	Label	Number
If critical section for shear measured from halfway between face of column or pedestal and edge of steel base.	X		

DLT 15.5(d) Critical Section - 3		1	2
C1	Critical section for shear measured from halfway between face of column or pedestal and edge of steel base.	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT 15.5(e)	X	X

Datum 15.5(e)	Source	Label	Number
If footing supported on a pile.	X		
If the center of a pile $\geq d_{p/2}^{*}$ outside the section under consideration.	X		
If the center of a pile $\geq d_{p/2}$ inside the section under consideration.	X		
If the section under consideration is at an intermediate position between $d_{p/2}$ inside the section and $d_{p/2}$ outside the section.	X		

DLT 15.5(e) Pile Caps - 1		1	2	3	4	5	
C1	Footing supported on piles?	Y	Y	Y	Y	N	
C2	Center of pile $\geq d_{p/2}$ outside the section under consideration?	Y	N	N	N		E
C3	Center of pile $\geq d_{p/2}$ inside the section under consideration?	N	Y	N	N		L S
C4	Section under consideration is at an intermediate position between $d_{p/2}$ inside the section and $d_{p/2}$ outside the section?	N	N	Y	N		E
A1	DLT 15.5(f)	X					
A2	DLT 15.5(g)		X				
A3	DLT 15.5(h)			X			
A4	No Provision				X		
A5	DLT Chapter 15				X	X	
A6	Logical Error						X

Comment:

1) DLT 15.5(e) is a switching DLT that partially covers Section 15.5.3.

---

* d_p = diameter of pile at footing base.

Datum 15.5(f)	Source	Label	Number
If entire pile reaction considered as producing shear on the section.	X		

DLT 15.5(f) Pile Caps - 2		1	2
C1	Entire pile reaction considered as producing shear on the section?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT Ch. 15	X	X

Comment: 1) DLT 15.5(f) covers Section 15.5.3(a).

Datum 15.5(g)	Source	Label	Number
If reaction from any pile considered as producing no shear on that section.	X		

DLT 15.5(g) Pile Caps - 3		1	2
C1	Reaction from any pile considered as producing no shear on that section?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT Ch. 15	X	X

Comment: 1) DLT 15.5(g) partially covers Section 15.5.3(b).

Datum 15.5(h)	Source	Label	Number
If the portion of the pile reaction to be considered as producing shear on the section based on straight-line interpolation between full value of $d^*_{p/2}$ outside the section and zero value at $d_{p/2}$ inside the section.	X		

DLT 15.5(h) Pile Caps - 4		1	2
C1	The portion of the pile reaction to be considered as producing shear on the section based on straight-line interpolation between full value at $d_{p/2}$ outside the section and zero value at $d_{p/2}$ inside the section?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT Chapter 15	X	X

Comment:

1) DLT 15.5(h) covers Section 15.5.3(c).

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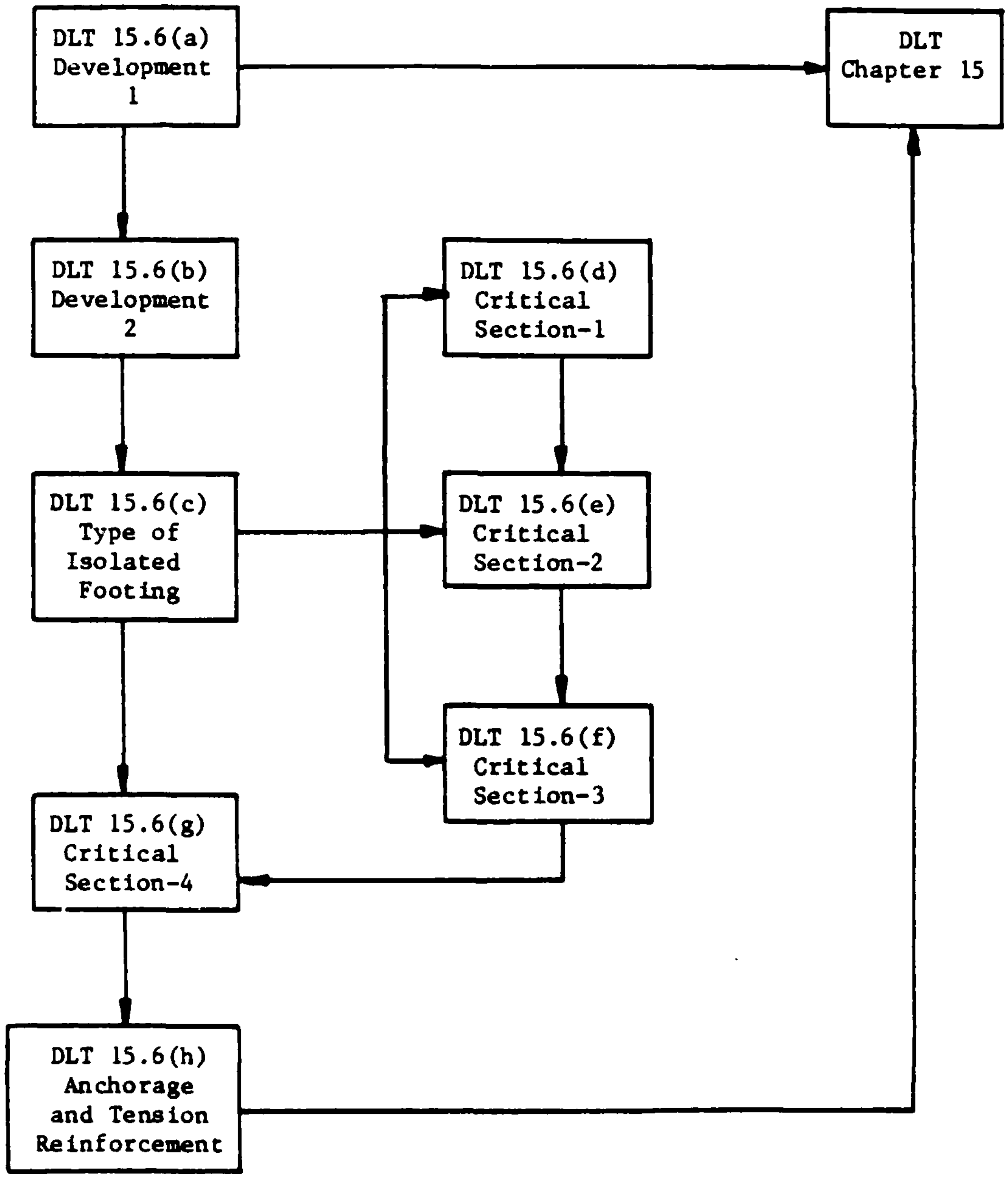
* d_p = diameter of pile at footing base.

Section 15.6 Map



Section 15.6 Development of Reinforcement in Footings

Datum 15.6(a)	Source	Label	Number
If computation of development of reinforcement in footings is in accordance with Chapter 12.	X		

DLT 15.6(a) Development - 1		1	2
C1	Computation of development of reinforcement in footings in accordance with Chapter 12?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT 15.6(b)	X	X

Comment: 1) DLT 15.6(a) covers Section 15.6.1.

Datum 15.6(b)	Source	Label	Number
If calculated tension or compression in reinforcement at each section developed on each side of that section by proper embedment length, end anchorage, hooks (tension only), or combinations thereof.	X		

DLT 15.6(b) Development - 2		1	2
C1	Calculated tension or compression in reinforcement at each section developed on each side of that section by proper embedment length, end anchorage, hooks (tension only), or combination thereof?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT 15.6(c)	X	X

Comment: 1) DLT 15.6(b) covers Section 15.6.2.

Datum 15.6(c)	Source	Label	Number
If footing is an isolated footing supporting a concrete column, pedestal, or wall.	X		
If footing is an isolated footing supporting a masonry wall.	X		
If footing is an isolated footing supporting a column with steel base plates.	X		

DLT 15.6(c) Type of Isolated Footing		1	2	3	4	
C1	Footing = isolated footing supporting a concrete column, pedestal, or wall?	Y	N	N	N	E L
C2	Footing = isolated footing supporting a masonry wall?	N	Y	N	N	S
C3	Footing = isolated footing supporting a column with steel base plates?	N	N	Y	N	E
A1	DLT 15.6(d)	X				
A2	DLT 15.6(e)		X			
A3	DLT 15.6(f)			X		
A4	No Provision, DLT 15.6(g)				X	
A6	Logical Error					X

Comment: 1) DLT 15.6(c) is a switching DLT.

Datum 15.6(d)	Source	Label	Number
If development of reinforcement computed at face of column, pedestal, or wall.	X		

DLT 15.6(d) Critical Section - 1		1	2
C1	Development of reinforcement computed at face of column, pedestal, or wall?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT 15.6(e)	X	X

Comment: 1) DLT 15.6(d) partially covers Section 15.6.3.

Datum 15.6(e)	Source	Label	Number
If development of reinforcement computed halfway between middle and edge of wall.	X		

DLT 15.6(e) Critical Section - 2		1	2
C1	Development of reinforcement computed halfway between middle and edge of wall?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT 15.6(f)	X	X

Comment: 1) DLT 15.6(e) partially covers Section 15.6.3.

Datum 15.6(f)	Source	Label	Number
If development of reinforcement computed halfway between face of the column and the edge of the steel base.	X		

DLT 15.6(f)	Critical Section - 3	1	2
C1	Development of reinforcement computed halfway between face of the column and the edge of the steel base plate?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT 15.6(g)	X	X

Comment: 1) DLT 15.6(f) partially covers Section 15.6.3.

Datum 15.6(g)	Source	Label	Number
If development of reinforcement computed at all vertical planes where changes of section or reinforcement occur.	X		

DLT 15.6(g) Critical Section - 4		1	2
C1	Development of reinforcement computed at all vertical planes where changes of section or reinforcement occur?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT 15.6(h)	X	X

Comment: 1) DLT 15.6(g) partially covers Section 15.6.3.

Datum 15.6(h)	Source	Label	Number
If reinforcement stress is not directly proportional to moment.	X		
If adequate end anchorage is provided for tension reinforcement in flexural members.*	X		

DLT 15.6(h) Anchorage for Tension Reinforcement		1	2	3
C1	Reinforcement stress not directly proportional to moment?	Y	Y	N
C2	Adequate end anchorage is provided for tension reinforcement in flexural member?	Y	N	I
A1	Provision = satisfied	X		X
A2	Provision ≠ satisfied		X	
A3	DLT Chapter 15	X	X	X

Comments:

1) DLT 15.6(h) covers Section 12.11.6.

2) According to Section 15.6.3, Section 12.11.6 appears to be applicable.

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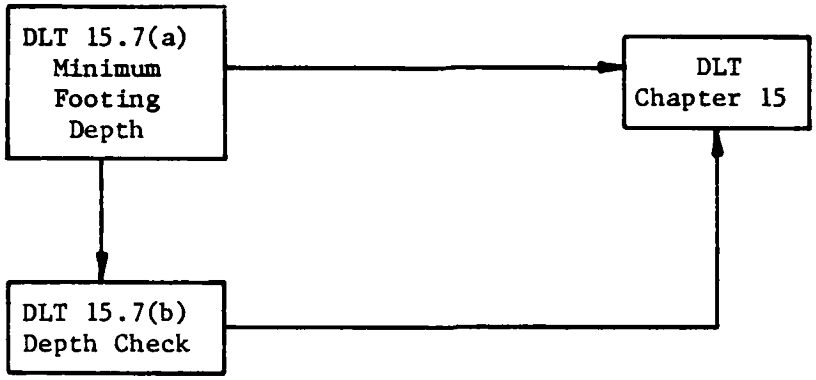
* Such members include: sloped, stepped, or tapered footings; brackets; deep flexural members; or members in which tension reinforcement is not parallel to compression face.

Section 15.7 Map



Section 15.7 Minimum Footing Depth

Datum 15.7(a)	Source	Label	Number
If footing is on soil.	X		
If footing is on piles.	X		

DLT 15.7(a)	Minimum Footing Depth	1	2	3	
C1	Footing on pile?	Y	N	N	ELSE
C2	Footing on soil?	N	Y	N	
A1	$D_{min} = 12$	X			
A2	$D_{min} = 6$		X		
A3	No Provision, DLT Ch. 15			X	
A4	DLT 15.7(b)	X	X		
A5	Logical Error				X

Comments: 1) DLT 15.7(a) partially covers Section 15.7.

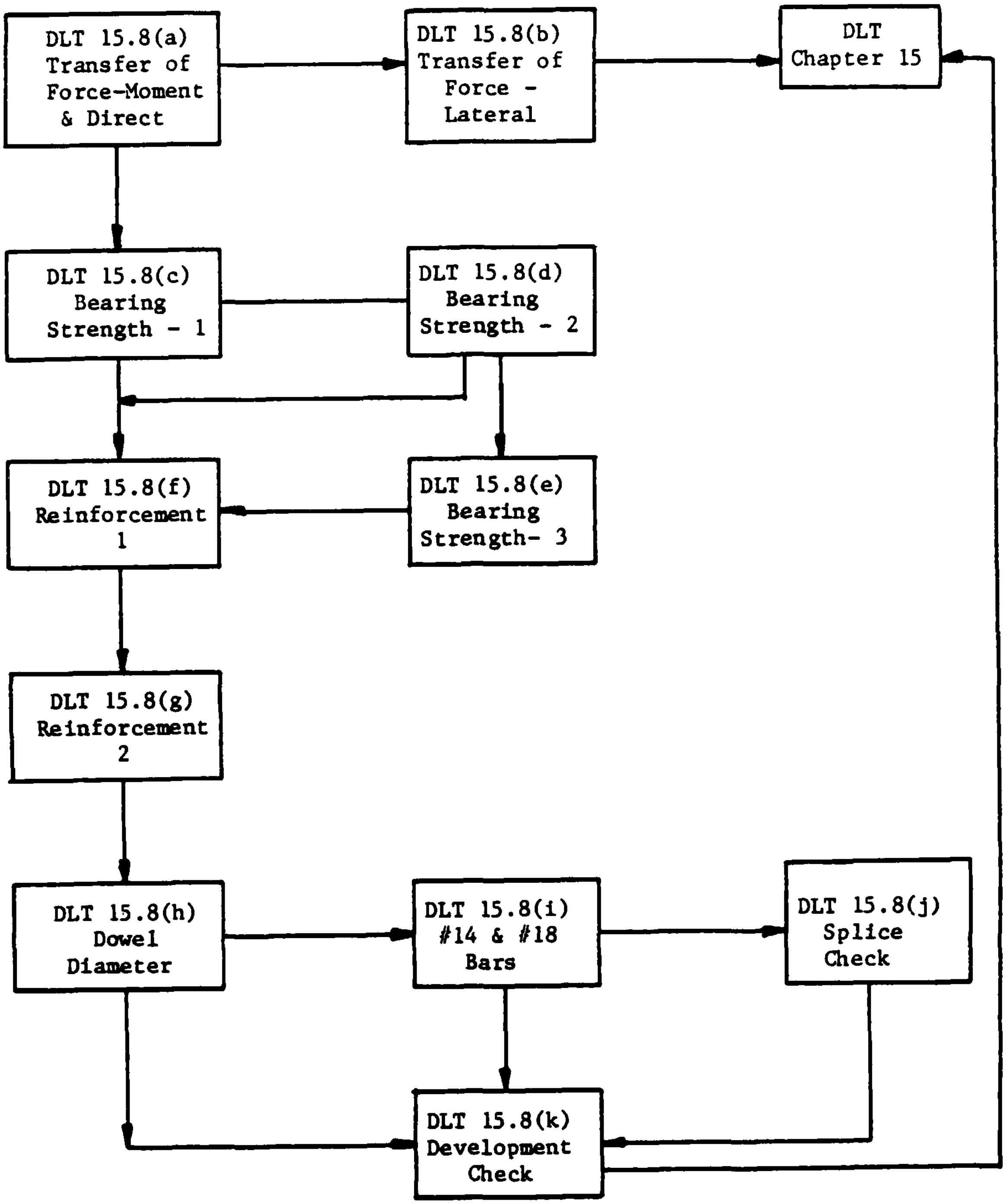
2) It is possible for a footing to be on soil as well as piles. However, it was assumed that if piles are present, they are the main source of load resistance and hence the 12 in. minimum.

Datum 15.7(b)	Source	Label	Number
Depth of footing above bottom reinforcement used in design.	X	D	
Minimum depth of footing.	DLT 15.7(a)	D_{min}	

DLT 15.7(b) Depth Check		1	2
C1	$D \geq D_{min}$?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT Ch. 15	X	X

Comment: 1) DLT 15.7(b) partially covers Section 15.7.

Section 15.8 Map



Section 15.8 Transfer of Force at Base of Column or Reinforced Pedestal

Datum 15.8(a)	Source	Label	Number
If all forces and moments applied at base of column or pedestal transferred to top of supporting pedestal or footing by bearing on concrete and by reinforcement.	X		
If required loading conditions include uplift.	X		
If total tensile force resisted by reinforcement.	X		

DLT 15.8(a)	Transfer of Force - Moment & Direct	1	2	3	4	5	
C1	All vertical forces and moments applied at base of column or pedestal transferred to top of supporting pedestal or footing by bearing on concrete and by reinforcement?	Y	Y	Y	N	N	E L
C2	Required loading conditions include uplift?	Y	Y	N	Y	N	S E
C3	Total tensile force resisted by reinforcement?	Y	N		I		
A1	Provisions = satisfied	X		X			
A2	Provisions ≠ satisfied		X		X	X	
A3	DLT 15.8(c)	X	X	X			
A4	DLT 15.8(b)				X	X	
A5	Logical Error						X

Comments: 1) DLT 15.8(a) covers Section 15.8.1.

2) Section 15.8.1 would be more accurately phrased if it were stated "All forces and moments except lateral forces applied..." because transfer of lateral forces is covered in Section 15.8.2. Section 15.8.1 seems to apply to vertical forces due to direct or flexural loads.

Datum 15.8(b)	Source	Label	Number
If lateral forces transferred to footings by shear keys or other means.	X		

DLT 15.8(b) Transfer of Force - Lateral		1	2
C1	Lateral forces transferred to footings by shear keys or other means?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT Ch. 15	X	X

Comment: 1) DLT 15.8(b) covers Section 15.8.2.

Datum 15.8(c)	Source	Label	Number
Bearing force on contact surface between supported and supporting members.	X		
Strength reduction factor.	X	ϕ	
Loaded area.	X	A_1	
Specified compressive strength of concrete, psi, of supported member.	X	f'_{c1}	
Specified compressive strength of concrete, psi, of supporting member.	X	f'_{c2}	

DLT 15.8(c) Bearing Strength - 1		1	2	3	4
C1	Bearing on contact surface between supported and supporting member $\leq \phi[0.85\ f'_{c1}A_1]$?	Y	Y	N	N
C2	Bearing on contact surface between supported and supporting member $\leq \phi[0.85\ f'_{c2}A_1]$?	Y	N	Y	N
A1	Provisions = satisfied	X	X		
A2	Provisions $\neq$ satisfied			X	X
A3	DLT 15.8(d)		X		X
A4	DLT 14.8(f)	X		X	

Comment: 1) DLT 15.8(c) partially covers Section 15.8.3.

Datum 15.8(d)	Source	Label	Number
Maximum area of the portion of the supporting surface that is geometrically similar to and concentric with the loaded area.	X	A_2	
Loaded area.	X	A_1	
Specified compressive strength of concrete, psi, of supporting member.	X	f'_{c2}	
Strength reduction factor	X	ϕ	
If supporting surface is wider on all sides than the loaded area.	X		

DLT 15.8(d) Bearing Strength - 2		1	2	3	
C1	Supporting surface wider on all sides than the loaded area?	Y	Y	N	ELSE
C2	Bearing on concrete $\leq \left\{\min\left[\sqrt{A_2/A_1}\ ,\ 2.0\right]\right\}\left\{\phi\left[0.85\ f'_{c2}A_1\right]\right\}$?	Y	N		
A1	Provisions = satisfied	X			
A2	Provisions ≠ satisfied			X	
A3	DLT 15.8(e)		X		
A4	DLT 15.8(f)	X		X	
A5	Logical Error				X

Comments: 1) DLT 15.8(d) partially covers Section 15.8.3.

2) Note that if the supporting surface is not wider on all sides than the loaded area, then A_2 as defined in the Code and illustrated in the Commentary cannot exist.

Datum 15.8(e)	Source	Label	Number
Loaded area.	X	A_1	
Area of the lower base of the largest frustum of a right pyramid or core contained wholly within the support and having for its upper base the loaded area and having side slopes of 1 vertical to 2 horizontal.	X	$\bar{A}_2$	
If top of support is stepped or sloped.	X		
Specified compressive strength of concrete, psi, of supporting member.	X	f'_{c2}	
Strength reduction factor.	X	ϕ	

DLT 15.8(e) Bearing Strength - 3		1	2	3	
C1	Top of support sloped or stepped?	Y	Y	N	E L S E
C2	Design bearing strength on concrete $\leq \left\{ \min\left[\sqrt{\bar{A}_2/A_1}\ ,\ 2\right]\right\}\left\{\phi[0.85\ f'_c A_1]\right\}$?	Y	N	N	
A1	Provisions = satisfied	X			
A2	Provisions ≠ satisfied		X	X	
A3	DLT 15.8(f)	X	X	X	
A4	Logical Error				X

Comments: 1) DLT 15.8(e) partially covers Section 15.8.3.

2) If the top of the support is not sloped or stepped, then $\bar{A}_2 = A_2$ and the response to C2 must be N to be compatible with DLT 10.16(b).

Datum 15.8(f)	Source	Label	Number
If reinforcement provided across interface between supported and supporting members.	X		
If reinforcement = extending longitudinal bars into supporting member	X		
If reinforcement = dowels.	X		

DLT 15.8(f) Reinforcement - 1		1	2	3	4	
C1	Reinforcement provided across interface between supporting and supported member?	Y	Y	Y	N	E
						L
C2	Reinforcement = extending longitudinal bars into supporting member?	Y	N	N		S
C3	Reinforcement = dowels?	I	Y	N		E
A1	Provisions = satisfied	X	X			
A2	Provisions ≠ satisfied			X	X	
A3	DLT 15.8(g)	X	X			
A4	DLT 15.8(k)			X	X	
A5	Logical Error					X

Comment: 1) DLT 15.8(f) covers Section 15.8.4.

2) Section 15.8.4 states that reinforcement shall be bars <u>or</u> dowels. It is assumed here that it could be bars <u>and</u> dowels.

Datum 15.8(g)	Source	Label	Number
If reinforcement provided to transfer all force that exceeds concrete bearing strength.	X		
Number of bars and dowels.	X		
Area of reinforcement (bars and dowels).	X	A_r	
Gross area of supported member.	X	A_g	

DLT 15.8(g) Reinforcement - 2		1	2	3	4
C1	Reinforcement provided to transfer all force that exceeds concrete bearing strength?	Y	Y	Y	N
C2	Number of bars and dowels $\geq$ 4?	Y	Y	N	I
C3	$A_r \geq 0.005\ A_g$?	Y	N	I	I
A1	Provisions = satisfied	X			
A2	Provisions $\neq$ satisfied		X	X	X
A3	DLT 15.8(h)	X	X	X	X

Comments: 1) DLT 15.8(g) covers Section 15.8.4.1.

2) Section 15.8.4.1(b) does not refer to dowels as a possible means of reinforcement across the interface as does Section 15.8.4. C2 herein admits dowels as a method.

Datum 15.8(h)	Source	Label	Number
If dowels used.	X		
Diameter of dowels, in.	X	d_d	
Diameter of longitudinal bars, in.	X	d_b	

DLT 15.8(h) Dowel Diameter		1	2	3	
C1	Dowels used?	Y	Y	N	ELSE
C2	$d_d \leq d_b + 0.15$?	Y	N		
A1	Provisions = satisfied	X			
A2	Provisions ≠ satisfied		X		
A3	DLT 15.8(i)	X	X		
A4	DLT 15.8(k)			X	
A5	Logical Error				X

Comment: 1) DLT 15.8(h) covers Section 15.8.4.2.

Datum 15.8(i)	Source	Label	Number
If #14 or #18 longitudinal bars lap spliced with footing dowels to provide required area.	X		
If #14 or #18 longitudinal bars in compression only.	X		

DLT 15.8(i) #14 and #18 Bars		1	2	3
C1	#14 or #18 longitudinal bars lap spliced with footing dowels to provide required area?	Y	Y	N
C2	#14 or #18 longitudinal bars in compression only?	Y	N	I
A1	Provision = satisfied	X		
A2	Provision ≠ satisfied		X	
A3	DLT 15.8(j)	X	X	
A4	DLT 14.8(k)			X

Comment: 1) DLT 15.8(i) partially covers Section 15.8.6.

Datum 15.8(j)	Source	Label	Number
Dowel size.	X		
Distance dowel extends into column.	X	DEC	
Development length provided for dowel in footing.	X	ℓ_{df}	
Development length required for dowel.	Chapter 12	BDLFD	
Splice length required for dowel.	Chapter 12	SLD	
Development length required for #14 or #18 bars.	Chapter 12	BDLF	

DLT 15.8(j) Splice Check		1	2	3	4
C1	Dowel size $\leq$ #11?	Y	Y	Y	N
C2	DEC $\geq$ max[BDLF, SLD]?	Y	Y	N	I
C3	$\ell_{df} \geq$ BDLFD?	Y	N	I	I
A1	Provisions = satisfied	X			
A2	Provisions $\neq$ satisfied		X	X	X
A3	DLT 15.8(k)	X	X	X	X

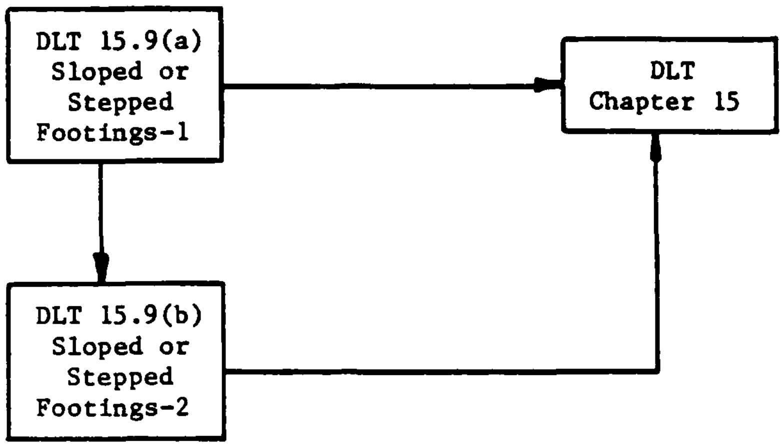
Comment: 1) DLT 15.8(j) covers Section 15.8.6.

Datum 15.8(k)	Source	Label	Number
If development of reinforcement in supporting and supported member, for transfer of force by reinforcement, in accordance with Chapter 12.	X		

DLT 15.8(k) Development Check		1	2
C1	Development of reinforcement in supporting and supported member, for transfer of force by reinforcement, in accordance with Chapter 12?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT Ch. 15	X	X

Comment: 1) DLT 15.8(k) covers Section 15.8.5.

Section 15.9 Map



Section 15.9 Sloped or Stepped Footings

Datum 15.9(a)	Source	Label	Number
If sloped or tapered footing.	X		
If angle of slope or depth and location of steps are such that design requirements are satisfied at every section.	X		

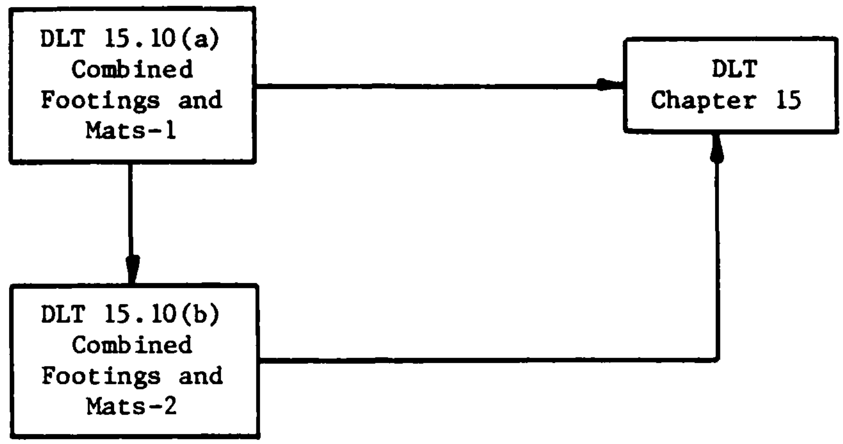
DLT 15.9(a) Sloped or Stepped Footings - 1		1	2	3	
C1	Sloped or stepped footing?	Y	Y	N	ELSE
C2	Angle of slope or depth and location of steps are such that design requirements are satisfied at every section?	Y	N		
A1	Provision = satisfied	X			
A2	Provision ≠ satisfied		X		
A3	DLT 15.9(b)	X	X		
A4	DLT Ch. 15			X	
A5	Logical Error				X

Comment: 1) DLT 15.9(a) covers Section 15.9.1.

Datum 15.9(b)	Source	Label	Number
If sloped or stepped footings designed as a unit.	X		
If constructed to assure action as a unit.	X		

DLT 15.9(b) Sloped or Stepped Footings - 2		1	2	3
C1	Sloped or stepped footing designed as a unit?	Y	Y	N
C2	Constructed to assure action as a unit?	Y	N	I
A1	Provision = satisfied	X		
A2	Provision ≠ satisfied		X	X
A3	DLT Ch. 15	X	X	X

Section 15.10 Map



Section 15.10 Combined Footings and Mats

Datum 15.10(a)	Source	Label	Number
If footing supports more than one column, pedestal or wall (combined footings or mats).	X		
If proportioned to resist the factored loads and induced reactions in accordance with appropriate design requirements of the Code.	X		

DLT 15.10(a) Combined Footings or Mats - 1		1	2	3	
C1	Footing supporting more than one column, pedestal or wall (combined footings or mats)?	Y	Y	N	ELSE
C2	Proportioned to resist the factored loads and induced reactions in accordance with appropriate design requirements of the Code?	Y	N		
A1	Provision = satisfied	X			
A2	Provision ≠ satisfied		X	X	
A3	DLT 15.10(b)	X	X		
A4	DLT Ch. 15			X	
A5	Logical Error				X

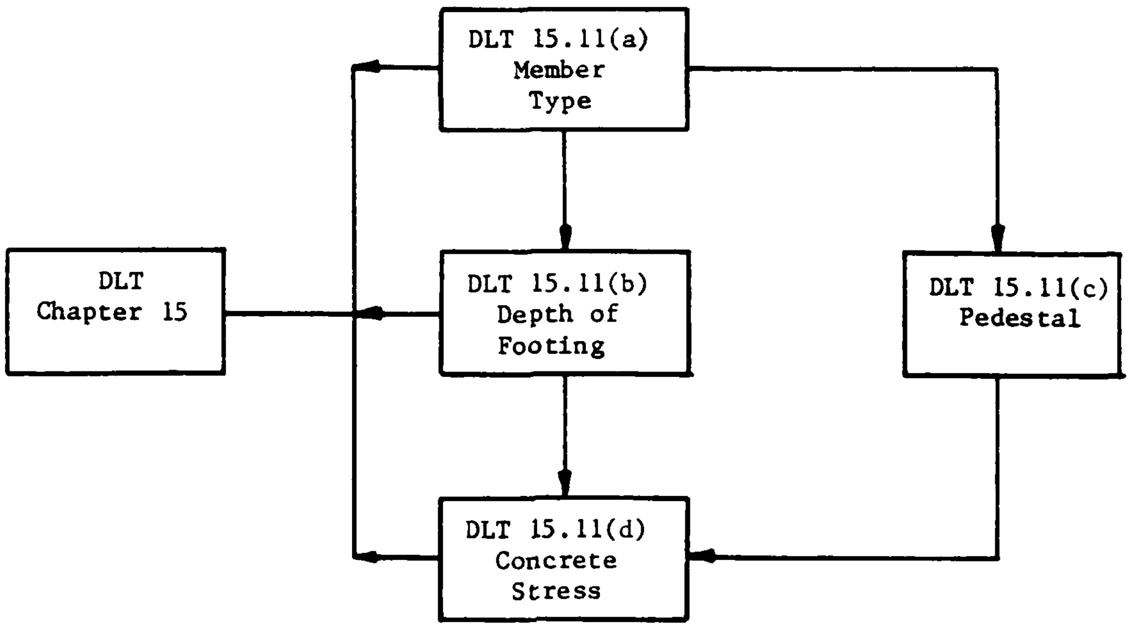
Comment: 1) DLT 15.10(a) covers Section 15.10.1.

Datum 15.10(b)	Source	Label	Number
If Direct Design Method of Chapter 13 used for design of combined footings or mats.	X		
If distribution of soil pressure under combined footings or mats is consistent with properties of the soil and the structure and with established principles of soil mechanics.	X		

DLT 15.10(b)	Combined Footings and Mats - 2	1	2	3
C1	Direct Design Method of Chapter 13 used?	Y	N	N
C2	Distribution of soil pressure under combined footings or mats is consistent with properties of the soil and the structure and with established principles of soil mechanics?	I	Y	N
A1	Provisions = satisfied		X	
A2	Provisions ≠ satisfied	X		X
A3	DLT Ch. 15	X	X	X

Comment: 1) DLT 15.10(b) covers Sections 15.10.2 and 15.10.3.

Section 15.11 Map



Section 15.11 Plain Concrete Pedestals and Footings

Datum 15.11(a)	Source	Label	Number
If member type = plain concrete footing.	X		
If member type = plain concrete pedestal on soil.	X		

DLT 15.11(a)	Member Type	1	2	3	
C1	Member = plain concrete footing?	Y	N	N	ELSE
C2	Member = plain concrete pedestal on soil?	N	Y	N	
A1	DLT 15.11(b)	X			
A2	DLT 15.11(c)		X		
A3	DLT Ch. 15			X	
A4	Logical Error				X

Comment: 1) DLT 15.11(a) is a switching DLT.

Datum 15.11(b)	Source	Label	Number
If footing on piles.	X		
Footing depth.	X	DOF	

DLT 15.11(b) Depth of Footing		1	2	3
C1	Footing on piles?	Y	N	N
C2	DOF $\geq$ 8 in.?	I	Y	N
A1	Provision = satisfied		X	
A2	Provision $\neq$ satisfied	X		X
A3	DLT 15.11(d)		X	X
A4	DLT Ch. 15	X		

Comments: 1) DLT 15.11(b) covers Sections 15.11.3 and 15.11.4.

2) It is assumed that a footing not on piles is on soil.

Datum 15.11(c)	Source	Label	Number
Maximum bearing stress in pedestal.	X		
Concrete bearing stress allowable.*	Section 10.16	f_{cb}	

DLT 15.11(c) Pedestals		1	2
C1	Maximum bearing stress in pedestal $\leq f_{cb}$?	Y	N
A1	Provision = satisfied	X	
A2	Provision $\neq$ satisfied; redesign as a reinforced concrete member		X
A3	DLT 15.11(d)	X	X

Comments:

1) DLT 15.11(c) partially covers Section 15.11.2.
2) It is assumed that "compression stress" referred to in the first sentence of this section is bearing stress.
3) The terms used in the Code here are not consistent, i.e., "stress" is compared to "strength."

* Section 10.16 provides bearing strength. The strength provided must be converted to stress for use here.

Datum 15.11(d)	Source	Label	Number
Maximum flexural tensile stress of extreme fiber for plain concrete footing or pedestal.	X	f_{cf}	
Maximum shear stress in plain concrete footing or pedestal with one-way beam action.	X	f_{cs1}	
Maximum shear stress in plain concrete footing or pedestal with two-way action.	X	f_{cs2}	
Square root of specified compressive strength of concrete, psi.	X	$\sqrt{f'_c}$	
Strength reduction factor.	X	ϕ	

DLT 15.11(d)	Concrete Stress	1	2	3	4	5	6	
C1	$f_{cf} \leq 5\ \phi\sqrt{f'_c}$?	Y	Y	Y	Y	N	N	E
C2	Footing or pedestal on soil acting in one-way beam action?	Y	Y	N	N	Y	N	L
								S
C3	$f_{cs1} \leq 2\ \phi\sqrt{f'_c}$?	Y	N			I		
								E
C4	$f_{cs2} \leq 4\ \phi\sqrt{f'_c}$?			Y	N		I	
A1	Provisions = satisfied	X		X				
A2	Provisions ≠ satisfied		X		X	X	X	
A3	DLT Ch. 15	X	X	X	X	X	X	
A4	Logical Error							X

Comments:
1) DLT 15.11(d) partially covers Section 15.11.2.
2) It is assumed that the allowable stress applies to both footings.
3) It is assumed that if action is not one-way, it is two-way.
4) It is assumed that allowable shear stress for one-way members is $2\ \phi\sqrt{f'_c}$, not $2\sqrt{f'_c}$.

ACI CHAPTER 16: PRECAST CONCRETE

DLT Chapter 16		1	2	3	4	5	6	7	
C1	Scope?	Y	N	N	N	N	N	N	
C2	Design?	N	Y	N	N	N	N	N	E
C3	Precast wall panels?	N	N	Y	N	N	N	N	L
C4	Details?	N	N	N	Y	N	N	N	S
C5	Identification and marking?	N	N	N	N	Y	N	N	E
C6	Transportation, storage and erection?	N	N	N	N	N	Y	N	
A1	Section 16.1	X							
A2	Section 16.2		X						
A3	Section 16.3			X					
A4	Section 16.4				X				
A5	Section 16.5					X			
A6	Section 16.6						X		
A7	DLT 318-77 Index							X	
A8	Logical Error								X

Section 16.1 Map

Section 16.1 Scope

Datum 16.1(a)	Source	Label	Number
If concrete element is cast elsewhere than its final position in the structure.	X		

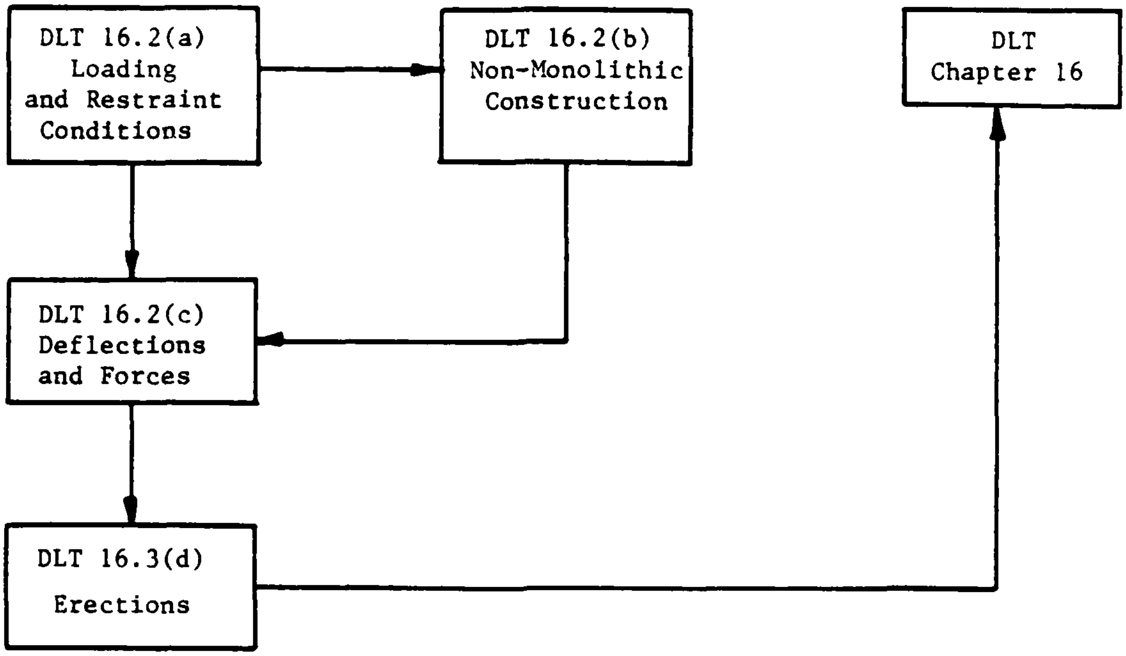
DLT 16.1(a) Application		1	2
C1	Concrete element cast elsewhere than its final position in the structure?	Y	N
A1	Provisions of Chapter 16 apply*	X	
A2	DLT 16.2(a)	X	
A3	DLT Ch. 16		X

Comment:

1) DLT 16.1(a) covers Section 16.1.1.

* All provisions of the Code not specifically excluded and not in conflict with provisions of Chapter 16, shall apply to precast concrete.

Section 16.2 Map



Section 16.2 Design

Datum 16.2(a)	Source	Label	Number
If design of precast members considers all loading and restraint conditions from initial fabrication to completion of the structure.*	X		
If the precast construction behaves monolithically.	X		

DLT 16.2(a) Loading and Restraint Condition		1	2	3	4
C1	Design of precast members considers all loading and restraint conditions from initial fabrication to completion of the structure?	Y	Y	N	N
C2	The precast construction behaves monolithically?	Y	N	Y	N
A1	Provision = satisfied	X	X		
A2	Provision ≠ satisfied			X	X
A3	DLT 16.2(b)		X		X
A4	DLT 16.2(c)	X		X	

Comment:

1) DLT 16.2(a) covers Section 16.2.1 and part of 16.2.2.

---

* Such conditions include form removal, storage transportation, and erection.

Datum 16.2(b)	Source	Label	Number
If effects at all interconnected and adjoining details considered to assure proper performance of the structural system.	X		

DLT 16.2(b) Non-Monolithic Construction		1	2
C1	Effects at all interconnected and adjoining details considered to assure proper performance of the structural system?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT 16.2(c)	X	X

Comment: 1) DLT 16.2(b) covers Section 16.2.2.

Datum 16.2(c)	Source	Label	Number
If effects of initial and long-time deflections considered, including effects on interconnected elements.	X		
If design of joints and bearings include effects of all forces to be transmitted, including shrinkage, creep, temperature, elastic deformation, wind, and earthquake.	X		

DLT 16.2(c) Deflections and Forces		1	2	3
C1	Effects of initial and long-time deflections considered, including effects of interconnected elements?	Y	Y	N
C2	Design of joints and bearings include effects of all forces to be transmitted, including shrinkage, creep, temperature, elastic deformation, wind, and earthquake.	Y	N	I
A1	Provisions = satisfied	X		
A2	Provisions ≠ satisfied		X	X
A3	DLT 16.2(d)	X	X	X

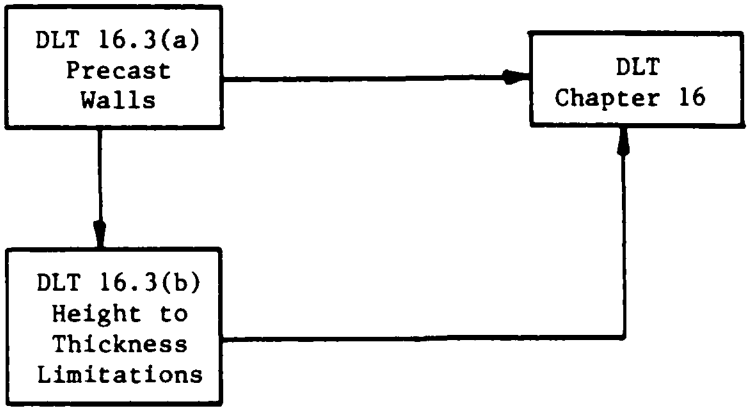
Comment: 1) DLT 16.2(c) covers Sections 16.2.3 and 16.2.4.

Datum 16.2(d)	Source	Label	Number
If all details designed to provide for manufacturing and erection tolerances and temporary erection stresses.	X		

DLT 16.2(d) Erections		1	2
C1	All details designed to provide for manufacturing and erection tolerances and temporary erection stresses?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT Ch. 16	X	X

Comment: 1) DLT 16.2(d) covers Section 16.2.5.

Section 16.3 Map



Section 16.3 Precast Wali Panels

Datum 16.3(a)	Source	Label	Number
If precast bearing and non-bearing walls designed in accordance with provisions of Section 10.15 or Chapter 14.	X		
If precast panels are designed to span horizontally to columns or isolated footings.	X		

DLT 16.3(a) Precast Walls		1	2	3	4
C1	Precast bearing and non-bearing walls designed in accordance with provisions of Section 10.15 or Chapter 14?	Y	Y	N	N
C2	Precast panels are designed to span horizontally to columns or isolated footings?	Y	N	Y	N
A1	Provision = satisfied	X	X		
A2	Provision ≠ satisfied			X	X
A3	DLT 16.3(b)	X		X	
A4	DLT Chapter 16		X		X

Comment:

1) DLT 16.3(a) covers Section 16.3.1 and part of Section 16.3.2.

Datum 16.3(b)	Source	Label	Number
If effect of deep beam action, lateral buckling and deflections are provided for in the design.*	X		
If the ratio of height to thickness limited.	X		

DLT 16.3(b)	Height to Thickness Limitations	1	2	3	4
C1	Effect of deep beam action, lateral buckling and deflections are provided for in design?	Y	Y	Y	N
C2	The ratio of height to thickness limited?	Y	N	Y	N
A1	Provisions = satisfied		X	X	
A2	Provisions ≠ satisfied	X			X
A3	DLT Chapter 16	X	X	X	X

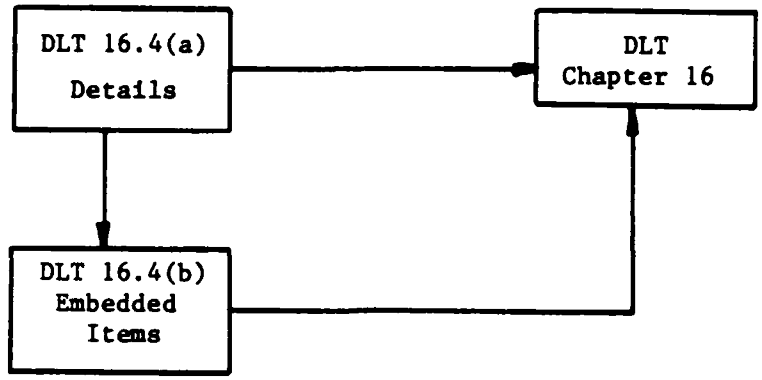
Comments:

1) DLT 16.3(b) covers Section 16.3.2.

2) It is assumed that if C1 is N , then the ratio height to thickness must be limited to be satisfactory.

* See Section 10.7.

Section 16.4 Map



Section 16.4 Details

Datum 16.4(a)	Source	Label	Number
If all details of reinforcement, connections, bearing seats, inserts, anchors, concrete cover, openings, lift devices, fabrication, and erection tolerances shown on the shop drawings.	X		
If embedded items (such as dowels or inserts) that either protrude from concrete or remain exposed for inspection are embedded while concrete is in a plastic state.	X		

DLT 16.4(a) Details		1	2	3	4
C1	All details of reinforcement, connections, bearing seats, inserts, anchors, concrete cover, openings, lift devices, fabrication, and erection tolerances shown on the shop drawings?	Y	Y	N	N
C2	Embedded items (such as dowels or inserts) that either protrude from concrete or remain exposed for inspection are embedded while concrete is in a plastic state?	Y	N	Y	N
A1	Provision = satisfied	X	X		
A2	Provision ≠ satisfied			X	X
A3	DLT 16.4(b)	X		X	
A4	DLT Chapter 16		X		X

Comment: 1) DLT 16.4(a) covers Section 16.4.1 and part of 16.4.2.

Datum 16.4(b)	Source	Label	Number
If embedded items are approved by the Engineer.	X		
If embedded items not required to be hooked or tied to reinforcement within plastic concrete.	X		
If embedded items maintained in correct position while concrete remains plastic.	X		
If embedded items properly anchored to develop required factored loads.	X		

DLT 16.4(b)	Embedded Items	1	2	3	4	5
C1	Embedded items approved by the Engineer?	Y	Y	Y	Y	N
C2	Embedded items not required to be hooked or tied to reinforcement within plastic concrete?	Y	Y	Y	N	I
C3	Embedded items maintained in correct position while concrete remains plastic?	Y	Y	N	I	I
C4	Embedded items properly anchored to develop required factored loads?	Y	N	I	I	I
A1	Provisions = satisfied	X				
A2	Provisions ≠ satisfied		X	X	X	X
A3	DLT Ch. 16	X	X	X	X	X

Comment: 1) DLT 16.4(b) covers Section 16.4.2.

Section 16.5 Map

Section 16.5 Identification and Marking

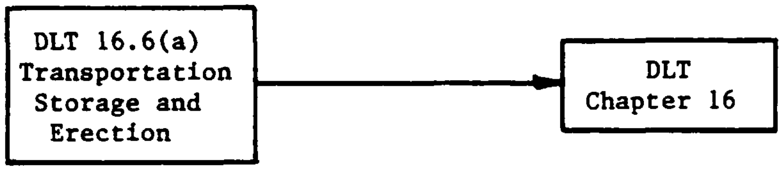
Datum 16.5(a)	Source	Label	Number
If each precast member or element marked to indicate location in structure, top surface, and date of fabrication.	X		
If identification marks correspond to placing plans.	X		

DLT 16.5(a) Identification		1	2	3
C1	Each precast member or element marked to indicate location in structure, top surface, and date of fabrication?	Y	Y	N
C2	Identification marks correspond to placing plans?	Y	N	I
A1	Provision = satisfied	X		
A2	Provision ≠ satisfied		X	X
A3	DLT Chapter 16	X	X	X

Comment:

1) DLT 16.5(a) covers Sections 16.5.1 and 16.5.2.

Section 16.6 Map



Section 16.6 Transportation, Storage, and Erection

Datum 16.6(a)	Source	Label	Number
If during curing, form removal, storage, transportation, and erection, precast members are not overstressed, warped, or otherwise damaged or have camber adversely affected.	X		
If precast members adequately braced and supported during erection to insure proper alignment and structural integrity until permanent connections are completed.	X		

DLT 16.6(a)	Transportation, Storage, Erection	1	2	3
C1	During curing, form removal, storage, transportation, and erection, precast members are not overstressed, warped, or otherwise damaged or have camber adversely affected?	Y	Y	N
C2	Precast members adequately braced and supported during erection to insure proper alignment and structural integrity until permanent connections are completed?	Y	N	I
A1	Provisions = satisfied	X		
A2	Provisions ≠ satisfied		X	X
A3	DLT Chapter 16	X	X	X

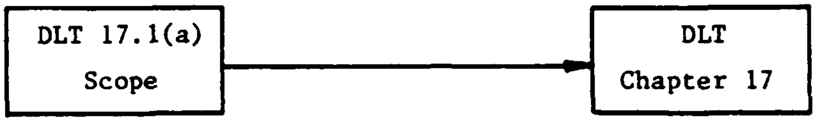
Comment:

1) DLT 16.6(a) covers Section 16.6.1 and 16.6.2.

ACI CHAPTER 17: COMPOSITE CONCRETE FLEXURAL MEMBERS

DLT Chapter 17		1	2	3	4	5	6	7	
C1	Scope?	Y	N	N	N	N	N	N	
C2	General?	N	Y	N	N	N	N	N	E
C3	Shoring?	N	N	Y	N	N	N	N	L
C4	Vertical Shear Strength?	N	N	N	Y	N	N	N	S
C5	Ties for Horizontal Shear?	N	N	N	N	Y	N	N	E
C6	Horizontal Shear Strength?	N	N	N	N	N	Y	N	
A1	Section 17.1	X							
A2	Section 17.2		X						
A3	Section 17.3			X					
A4	Section 17.4				X				
A5	Section 17.6					X			
A6	Section 17.5						X		
A7	DLT 318-77 Index							X	
A8	Logical Error								X

Section 17.1 Map



Section 17.1 Scope

Datum 17.1(a)	Source	Label	Number
If design uses composite concrete flexural members defined as precast and/or cast-in-place concrete elements constructed in separate placements but so interconnected that all elements respond to loads as a unit.	X		

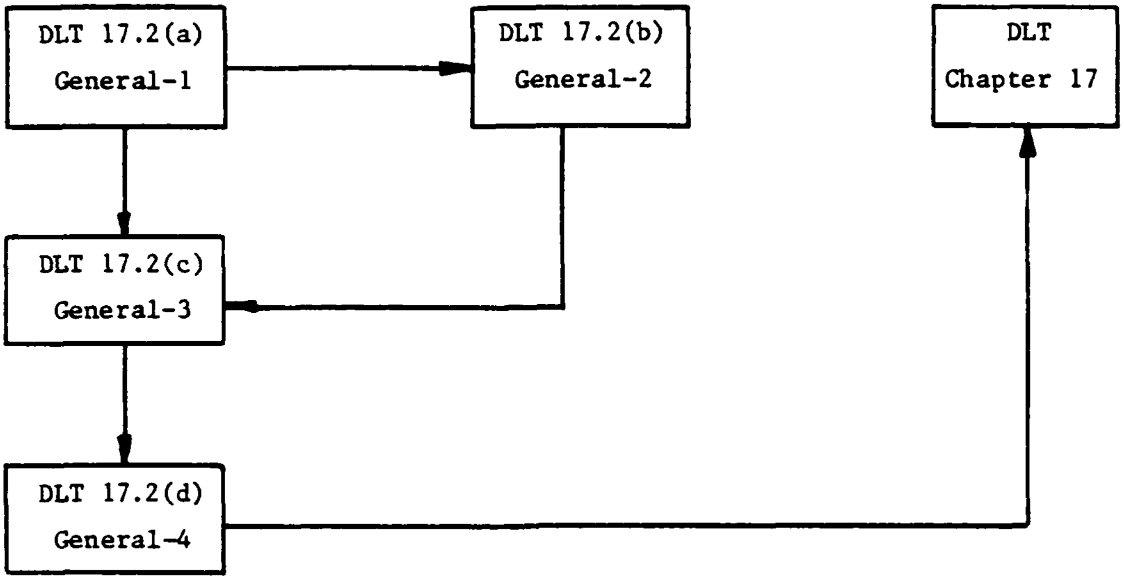
DLT 17.1(a) Scope		1	2
C1	Design uses composite concrete flexural members defined as precast and/or cast-in-place concrete elements constructed in separate placements but so interconnected that all elements respond to loads as a unit?*	Y	N
A1	DLT Ch. 17	X	
A2	Index		X

Comment:

1) DLT 17.1(a) covers Section 17.1.1.

* All provisions of the Code apply to composite concrete flexural members except as specifically modified in Chapter 17.

Section 17.2 Map



Section 17.2 General

Datum 17.2(a)	Source	Label	Number
If individual elements investigated for critical stages of loading.	X		
If an entire composite member or portions thereof used in resisting shear and moment.	X		
If the specified strength, unit weight, or other properties of the various elements are different.	X		

DLT 17.2(a) General - 1		1	2	3	4
C1	Individual elements investigated for critical stages of loading?	Y	Y	N	N
C2	An entire composite member or portions thereof used in resisting shear and moment?	I	I	I	I
C3	The specified strength, unit weight, or other properties of the various elements are different?	Y	N	Y	N
A1	Provisions = satisfied	X	X		
A2	Provisions ≠ satisfied			X	X
A3	DLT 17.2(b)	X		X	
A4	DLT 17.2(c)		X		X

Comment:

1) DLT 17.2(a) covers Section 17.2.1, 17.2.2, and part of 17.2.3.

Datum 17.2(b)	Source	Label	Number
If properties of the individual elements or most critical values used in design.	X		

DLT 17.2(b) General - 2		1	2
C1	Properties of the individual elements <u>or</u> most critical values used in design?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT 17.3(c)	X	X

Comment: 1) DLT 17.2(b) covers Section 17.2.3.

Datum 17.2(c)	Source	Label	Number
If no distinction is made between shored and unshored members in strength computations of composite members.	X		
If all elements designed to support all loads introduced prior to full development of design strength of composite members.	X		
If reinforcement provided as required to control cracking and to prevent separation of individual elements of composite members.	X		

DLT 17.2(c) General - 3		1	2	3	4
C1	No distinction made between shored and unshored members in strength computations of composite members?	Y	Y	Y	N
C2	All elements designed to support all loads introduced prior to full development of design strength of composite members?	Y	Y	N	I
C3	Reinforcement provided as required to control cracking and to prevent separation of individual elements of composite members?	Y	N	I	I
A1	Provisions = satisfied	X			
A2	Provisions ≠ satisfied		X	X	X
A3	DLT 17.2(d)	X	X	X	X

Comment: 1) DLT 17.2(c) covers Section 17.2.4, 17.2.5, 17.2.6.

Datum 17.2(d)	Source	Label	Number
If composite members meet requirements for control of deflections in accordance with Section 9.5.5.	X		

DLT 17.2(d) General - 4		1	2
C1	Composite members meet requirements for control of deflections in accordance with Section 9.5.5?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT Ch. 17	X	X

Comment: 1) DLT 17.2(d) covers Section 17.2.7.

Section 17.3 Map

DLT 17.3(a) Shoring → DLT Chapter 17

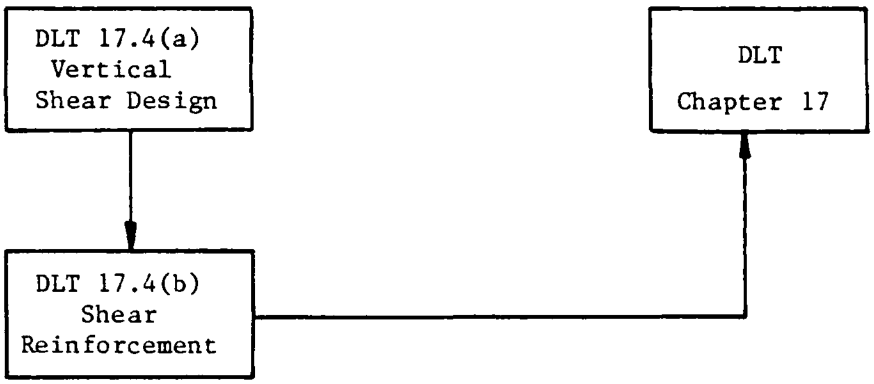
Section 17.3 Shoring

Datum 17.3(a)	Source	Label	Number
If shoring used.	X		
If shoring removed after supported elements have developed design properties required to support all loads and limit deflections and cracking at time of shoring removal.	X		

DLT 17.3(a) Shoring		1	2	3
C1	Shoring used?	Y	Y	N
C2	Shoring removed after supported elements have developed design properties required to support all loads and limit deflections and cracking at time of shoring removal?	Y	N	I
A1	Provisions = satisfied	X		
A2	Provisions ≠ satisfied		X	
A3	DLT Ch. 17	X	X	X

Comment: 1) DLT 17.3(a) covers Section 17.3.

Section 17.4 Map



Section 17.4 Vertical Shear Strength

Datum 17.4(a)	Source	Label	Number
If entire composite member is assumed to resist vertical shear.	X		
If design in accordance with Chapter 11 as for a monolithically cast member of the same cross-sectional shape.	X		

DLT 17.4(a)	Vertical Shear Design	1	2	3
C1	Entire composite member assumed to resist vertical shear?	Y	Y	N
C2	Design in accordance with Chapter 11 as for a monolithically cast member of the same cross-sectional shape?	Y	N	I
A1	Provision = satisfied	X		
A2	Provision ≠ satisfied		X	
A3	DLT 17.4(b)	X	X	X

Comment: 1) DLT 17.4(a) covers Section 17.4.1.

AD-A173 728 COMPUTER-AIDED STRUCTURAL ENGINEERING (CASE) PROJECT 5/6
DECISION LOGIC TABL (U) ATKINSON-NOLAND & ASSOCIATES
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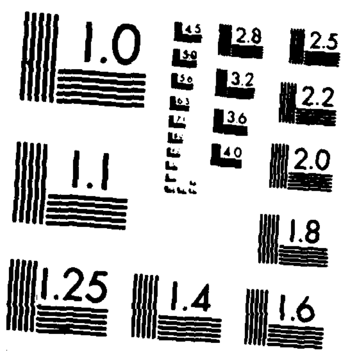


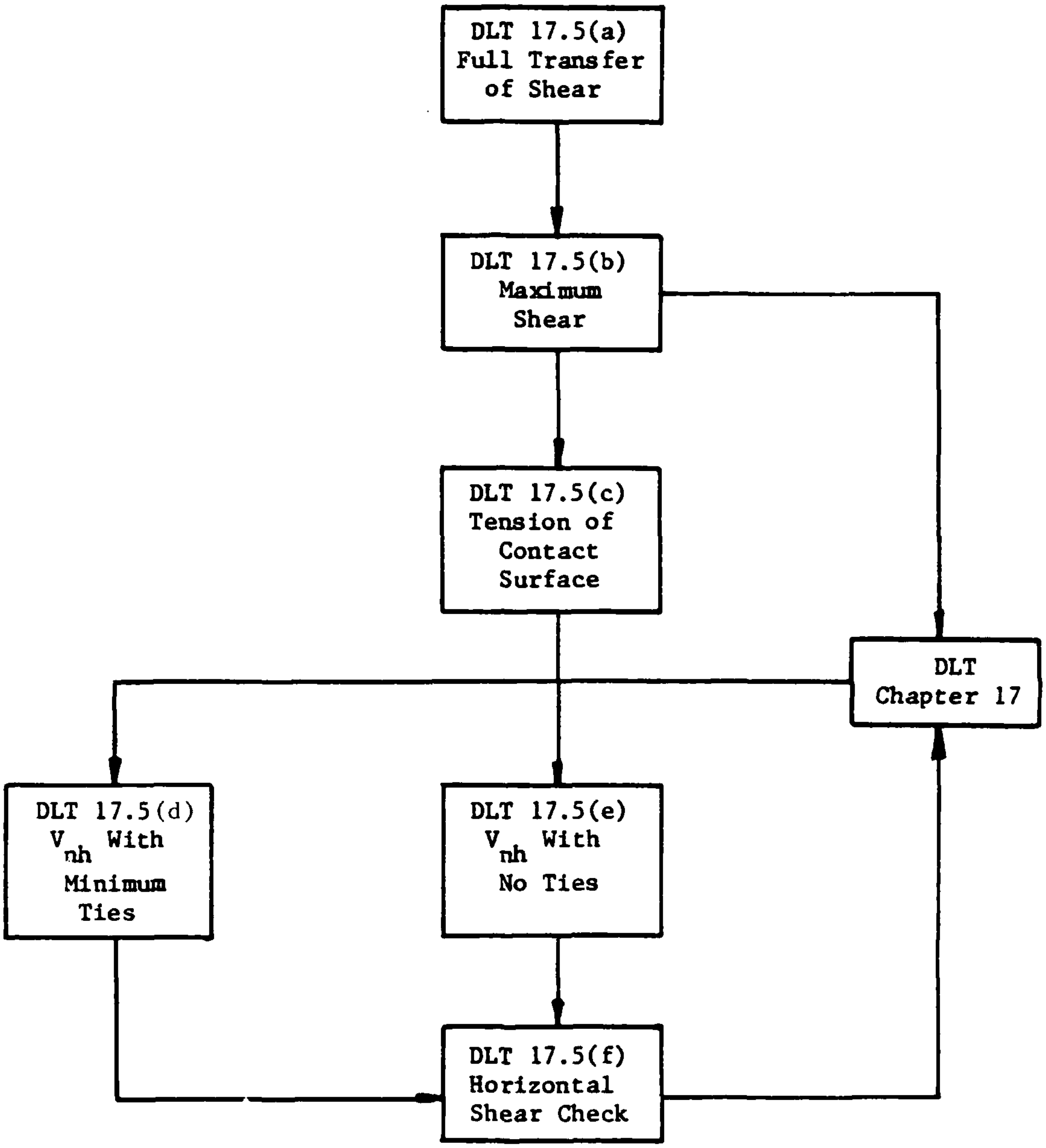
CROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963-A

Datum 17.4(b)	Source	Label	Number
If shear reinforcement fully anchored into interconnected elements in accordance with Section 12.14.	X		
If extended and anchored shear reinforcement included as ties for horizontal shear.	X		

DLT 17.4(b)	Shear Reinforcement	1	2
C1	Shear reinforcement fully anchored into interconnected elements in accordance with Section 12.14?	Y	N
C2	Extended and anchored shear reinforcement included as ties for horizontal shear?	I	I
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT Ch. 17	X	X

Comment: 1) DLT 17.4(b) covers Sections 17.4.2 and 17.4.3.

Section 17.5 Map



Section 17.5 Horizontal Shear Strength

Datum 17.5(a)	Source	Label	Number
If full transfer of horizontal shear forces assured at contact surfaces of interconnected elements.	X		

DLT 17.5(a)	Full Transfer of Shear	1	2
C1	Full transfer of horizontal shear force assured at contact surfaces of interconnected elements?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT 17.5(b)	X	X

Comment:

1) DLT 17.5(a) covers Section 17.5.1.

Datum 17.5(b)	Source	Label	Number
Factored shear force of section.	X	V_u	
If design for horizontal shear in accordance with Section 11.7.	X		
Width of cross section at contact surface being investigated for horizontal shear.	X	b_v	
Distance from extreme compression fiber to centroid of tension reinforcement for entire composite section, in.	X	d	
Strength reduction factor.	X	ϕ	

DLT 17.5(b) Maximum Shear		1	2	3	4
C1	$V_u > \phi\ 350\ b_v d$?	Y	Y	N	N
C2	Design for horizontal shear in accordance with Section 11.7?	Y	N	Y	N
A1	Provisions = satisfied	X		X	
A2	Provisions ≠ satisfied		X		
A3	DLT 17.5(c)				X
A4	DLT Ch. 17	X	X	X	

Comments: 1) DLT 17.5(b) covers Section 17.5.2.4.

2) It is assumed that for cases of $V_u > \phi 350 b_v d$ the requirements for reinforcement across the control surface provided by Section 11.7 supercede the requirements of Sections 17.5.6 and 17.6.

3) It is assumed that in cases where $V_u < \phi 350 b_v d$ and design is per Section 11.7, the Code has been satisfied.

Datum 17.5(c)	Source	Label	Number
If tension exists across contact surface between interconnected elements.	X		
If minimum ties provided in accordance with Section 17.6.	DLT 17.6(a)	B176	

DLT 17.5(c)	Tension at Contact Surface	1	2	3	4
C1	Tension exists across contact surface between interconnected elements?	Y	Y	N	N
C2	Minimum ties provided in accordance with Section 17.6?	Y	N	Y	N
A1	Provisions = satisfied	X			
A2	Provisions ≠ satisfied		X		
A3	DLT 17.5(d)	X		X	
A4	DLT 17.5(e)				X
A5	DLT Ch. 17		X		

Comment: 1) DLT 17.5(c) covers Section 17.5.6.

Datum 17.5(d)	Source	Label	Number
Width of cross section at contact surface being investigated for horizontal shear.	X	b_v	
Distance from extreme compression fiber to centroid of tension reinforcement for entire composite section, in.	X	d	
Area of contact surface.	X	A_c	
If contact surface is clean and free of laitence.	X		
If contact surfaces are intentionally roughened to a full amplitude of approximately 1/4 inch.	X		

DLT 17.5(d) V_{nh} with Minimum Ties		1	2	3
C1	Contact surfaces clean and free of laitence?	Y	Y	N
C2	Contact surfaces intentionally roughened to a full amplitude of approximately 1/4 inch?	Y	N	Y
A1	$V_{nh} = 80\ b_v d$		X	
A2	$V_{nh} = 350\ b_v d$	X		
A3	$\bar{V}_{nh} = 80\ A_c$		X	
A4	$\bar{V}_{nh} = 350\ A_c$	X		
A5	DLT 17.5(f)	X	X	
A6	No Provision, set $\bar{V}_{nh} = V_{nh} = 0$			X

Comment: 1) DLT 17.5(d) partially covers Sections 17.5.4.2, 17.5.4.3, and 17.5.5.5.

Datum 17.5(e)	Source	Label	Number
If contact surfaces are clean and free of laitence.	X		
If contact surfaces are intentionally roughened.	X		

DLT 17.5(e) V_{nh} With No Ties		1	2	3	4
C1	Contact surfaces clean and free of laitence?	Y	Y	N	N
C2	Contact surfaces intentionally roughened?	Y	N	Y	N
A1	$V_{nh} = 80\ b_v d$	X			
A2	$\overline{V}_{nh} = 80\ A_c$	X			
A3	No Provision, set $V_{nh} = \overline{V}_{nh} = 0$		X	X	X
A4	DLT 17.5(f)	X	X	X	X

Comment:

1) DLT 17.5(e) partially covers Sections 17.5.4.1 and 17.5.5.

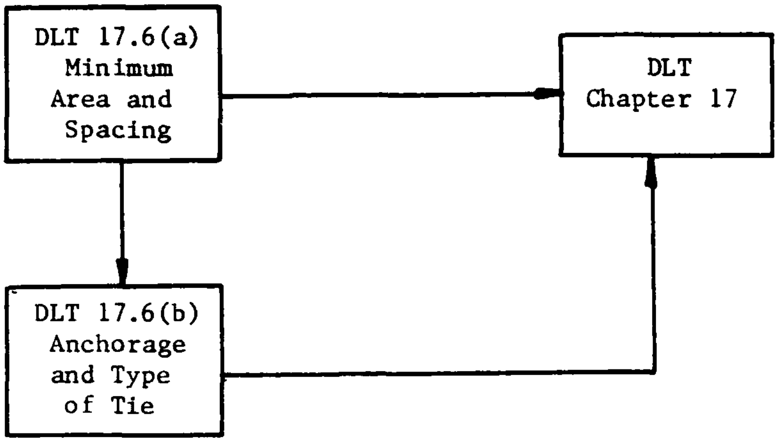
Datum 17.5(f)	Source	Label	Number
Factored shear force at section.	X	V_u	
Horizontal shear determined by computing the actual compressive or tensile force in any segment.	X	$\overline{V}_u$	
Strength reduction factor.	X	ϕ	
Shear strength based on $b_v d$.	DLT 17.5(d,e)	V_{nh}	
Shear strength based on A_c.		$\overline{V}_{nh}$	

DLT 17.5(f) Horizontal Shear Check		1	2	3	4
C1	$V_u \leq \phi\, V_{nh}$?	Y	Y	N	N
C2	$\overline{V}_u \leq \phi\, \overline{V}_{nh}$?	Y	N	Y	N
A1	Provisions = satisfied	X	X	X	
A2	Provisions ≠ satisfied				X
A3	DLT Chapter 17	X	X	X	X

Comment:

1) DLT 17.5(f) partially covers Sections 17.5.4 and 17.5.5.

Section 17.6 Map



Section 17.6 Ties for Horizontal Shear

Datum 17.6(a)	Source	Label	Number
If ties provided to transfer horizontal shear.	X		
Area of ties provided.	X	A_{vp}	
Web width, or diameter of circular section, in.	X	b_w	
Spacing of shear or torsion reinforcement in direction parallel to longitudinal reinforcement, in.	X	S	
Specified yield strength of nonprestressed reinforcement, psi.	X	f_y	
Tie spacing, in.	X	S_t	
Least dimension of supported element, in.	X	ℓ_s	

DLT 17.6(a)	Minimum Area and Spacing	1	2	3	4
C1	Ties provided to transfer horizontal shear?	Y	Y	Y	N
C2	$A_{vp} \geq 50\ b_w S/f_y$?	Y	Y	N	I
C3	$S_t \leq \min[4\ \ell_s,\ 24]$?	Y	N	I	I
A1	Provisions = satisfied	X			
A2	Provisions ≠ satisfied		X	X	
A3	DLT 17.6(b)	X	X	X	
A4	DLT Ch. 17				X

Comment: 1) DLT 17.6(a) covers Section 17.6.1.

Datum 17.6(b)	Source	Label	Number
If all ties fully anchored into inter-connected elements in accordance with Section 12.14.	X		
If ties consist of single bars or wire, multiple leg stirrups, or vertical legs of welded wire fabric (smooth or deformed).	X		

DLT 17.6(b) Anchorage and Type of Tie		1	2
C1	All ties fully anchored into interconnected elements in accordance with Section 12.14?	Y	N
C2	Ties consist of single bars or wire, multiple leg stirrups, or vertical legs of welded wire fabric (smooth or deformed)?	I	I
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT Ch. 17	X	X

Comment: 1) DLT 17.6(b) covers Section 17.6.2 and 17.6.3.

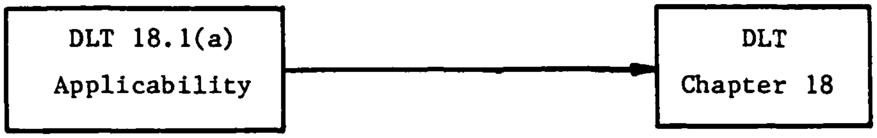
ACI CHAPTER 18: PRESTRESSED CONCRETE

DLT Chapter 18-1		1	2	3	4	5	6	7	8	9	10	
C1	Scope?	Y	N	N	N	N	N	N	N	N	N	
C2	General?	N	Y	N	N	N	N	N	N	N	N	
C3	Design assumptions?	N	N	Y	N	N	N	N	N	N	N	E
C4	Permissible stresses in concrete flexural members?	N	N	N	Y	N	N	N	N	N	N	L S
C5	Permissible stresses in prestressing tendons?	N	N	N	N	Y	N	N	N	N	N	E
C6	Loss of prestress?	N	N	N	N	N	Y	N	N	N	N	
C7	Flexural strength?	N	N	N	N	N	N	Y	N	N	N	
C8	Limits for reinforcement of flexural members?	N	N	N	N	N	N	N	Y	N	N	
C9	Minimum bonded reinforcement?	N	N	N	N	N	N	N	N	Y	N	
A1	Section 18.1	X										
A2	Section 18.2		X									
A3	Section 18.3			X								
A4	Section 18.4				X							
A5	Section 18.5					X						
A6	Section 18.6						X					
A7	Section 18.7							X				
A8	Section 18.8								X			
A9	Section 18.9									X		
A10	DLT Chapter 18-2										X	
A11	Logical Error											X

DLT Chapter 18-2		1	2	3	4	5	6	
C1	Statically indeterminate structures?	Y	N	N	N	N	N	
C2	Compression members combined flexure and axial loads?	N	Y	N	N	N	N	E
								L
C3	Slab systems?	N	N	Y	N	N	N	S
C4	Tendon anchorage?	N	N	N	Y	N	N	E
C5	Corrosion protection for unbonded prestressing tendons?	N	N	N	N	Y	N	
A1	Section 18.10	X						
A2	Section 18.11		X					
A3	Section 18.12			X				
A4	Section 18.13				X			
A5	Section 18.14					X		
A6	DLT Chapter 18-3						X	
A7	Logical Error							X

DLT Chapter 18-3		1	2	3	4	5	6	
C1	Post-tensioning ducts?	Y	N	N	N	N	N	
C2	Grout for bonded prestressing tendons?	N	Y	N	N	N	N	E
C3	Protection for prestressing tendons?	N	N	Y	N	N	N	L
C4	Application and measurement of prestressing force?	N	N	N	Y	N	N	S
C5	Post-tensioning anchorages and couplers?	N	N	N	N	Y	N	E
A1	Section 18.15	X						
A2	Section 18.16		X					
A3	Section 18.17			X				
A4	Section 18.18				X			
A5	Section 18.19					X		
A6	DLT 318-77 Index						X	
A7	Logical Error							X

Section 18.1 Map



Section 18.1 Scope

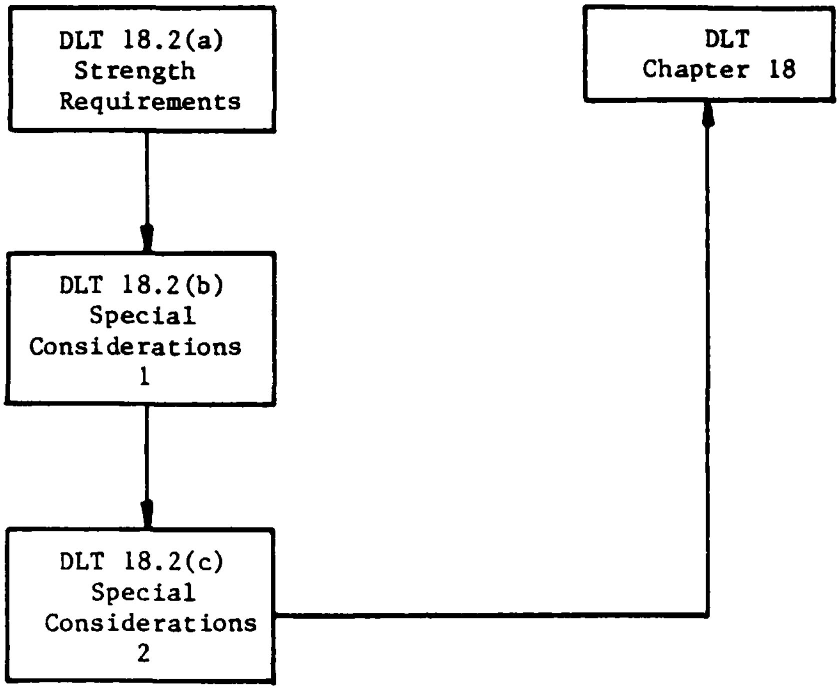
Datum 18.1(a)	Source	Label	Number
If member is prestressed with wire, strands, or bars conforming to provisions for prestressing tendons in Section 3.5.5.	X		

DLT 18.1(a) Applicability		1	2
C1	Member is prestressed with wire, strands, or bars conforming to provisions for prestressing tendons in Section 3.5.5?	Y	N
A1	Provisions of Chapter 18 apply	X	
A2	Provisions of Chapter 18 do not apply		X
A3	DLT 18.1(b)	X	
A4	DLT Chapter 18		X

Comment:

1) DLT 18.1(a) covers Section 18.1.1.

Section 18.2 Map



Section 18.2 General

Datum 18.2(a)	Source	Label	Number
If prestressed members meet the strength requirements of the Code.	X		
If design of prestressed members based on strength and on behavior at service conditions at all load stages that may be critical during the life of the structure from the time the prestress was first applied.	X		

DLT 18.2(a) Strength Requirements		1	2	3
C1	Prestressed members meet the strength requirements of Code?	Y	Y	N
C2	Design of prestressed members based on strength and on behavior at service conditions at all load stages that may be critical during the life of the structure from the time prestress is first applied?	Y	N	I
A1	Provisions = satisfied	X		
A2	Provisions ≠ satisfied		X	X
A3	DLT 18.2(b)	X	X	X

Comment: 1) DLT 18.1(a) covers Sections 18.2.1 and 18.2.2.

Datum 18.2(b)	Source	Label	Number
If stress concentrations due to pre-stressing considered in design.	X		
If provisions made for effects on adjoining construction of elastic and plastic deformations, deflections, changes in length, and rotations due to prestressing.	X		
If provisions made for the effects of temperature and shrinkage also included.	X		

DLT 18.2(b) Special Considerations - 1		1	2	3	4
C1	Stress concentrations due to prestressing considered in design?	Y	Y	Y	N
C2	Provisions made for effects on adjoining construction of elastic and plastic deformations, deflections, changes in length, and rotations due to prestressing?	Y	Y	N	I
C3	Provisions made for the effects of temperature and shrinkage?	Y	N	I	I
A1	Provisions = satisfied	X			
A2	Provisions ≠ satisfied		X	X	X
A3	DLT 18.2(c)	X	X	X	X

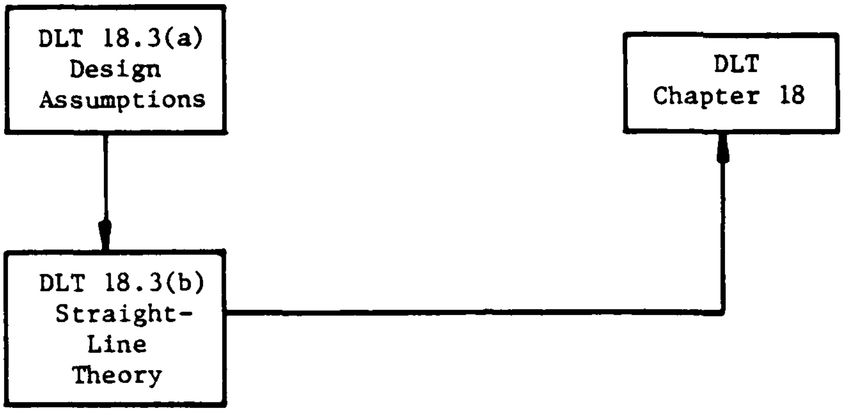
Comment: 1) DLT 18.2(b) covers Sections 18.2.3 and 18.2.4.

Datum 18.2(c)	Source	Label	Number
If possibility of buckling in a member between points where concrete and prestressing tendons are in contact and of buckling in thin webs and flanges considered.	X		
If effects of loss of area due to open ducts, in computing section properties prior to bonding of prestressing tendons considered.	X		

DLT 18.2(c) Special Considerations - 2		1	2	3
C1	Possibility of buckling in a member between points where concrete and prestressing tendons are in contact <u>and</u> of buckling in thin webs and flanges considered?	Y	Y	N
C2	Effect of loss of area due to open ducts considered in computing section properties prior to bonding of prestressing tendons?	Y	N	I
A1	Provisions = satisfied	X		
A2	Provisions ≠ satisfied		X	X
A3	DLT Ch. 18	X	X	X

Comment: 1) DLT 18.2(c) covers Sections 18.2.5 and 18.2.6.

Section 18.3 Map



Section 18.3 Design Assumptions

Datum 18.3(a)	Source	Label	Number
If strength design of prestressed members for flexure and axial loads based on assumptions given in Section 10.2.	X		
If Section 10.2.4 applies only to reinforcement conforming to Section 3.5.3.	X		

DLT 18.3(a)	Design Assumptions	1	2	3
C1	Strength design of prestressed members for flexure and axial loads based on assumptions given in Section 10.2?	Y	Y	N
C2	Provisions of Section 10.2.4 applied only to reinforcement conforming to Section 3.5.3?	Y	N	I
A1	Provisions = satisfied	X		
A2	Provisions ≠ satisfied		X	X
A3	DLT 18.3(b)	X	X	X

Comment: 1) DLT 18.3(a) covers Section 18.3.1.

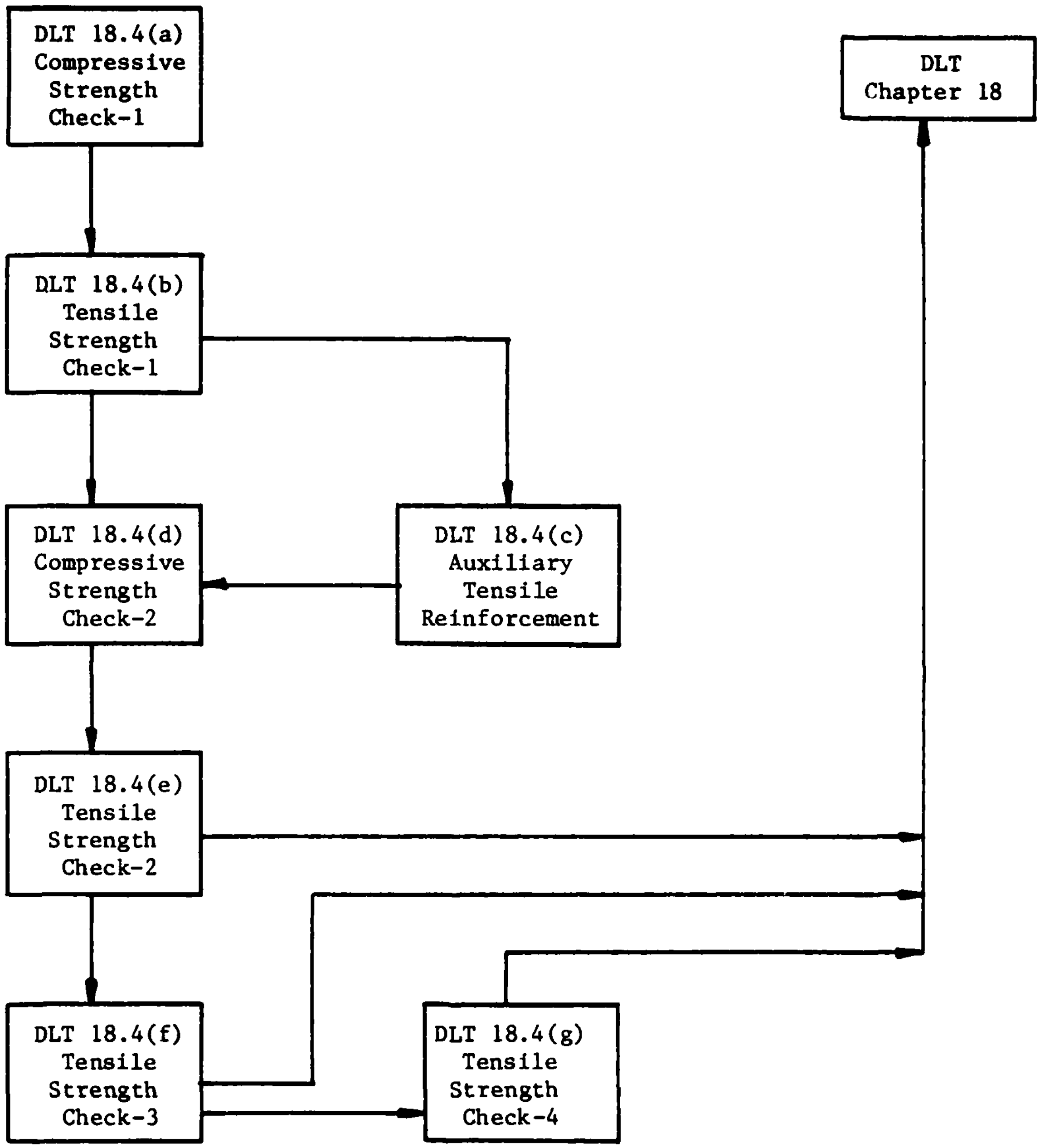
Datum 18.3(b)	Source	Label	Number
If straight-line theory used for investigation of stresses at transfer of prestress, at service loads, and at cracking loads.	X		
If strains assumed to vary linearly with depth through entire load range.	X		
If at cracked sections, concrete assumed to resist no tension.	X		

DLT 18.3(b)	Straight-Line Theory	1	2	3	4
C1	Straight-line theory used for investigation of stresses at transfer of prestress, at service loads, and at cracking loads?	Y	Y	Y	N
C2	Strains assumed to vary linearly with depth through entire load range?	Y	Y	N	I
C3	At cracked sections, concrete assumed to resist no tension?	Y	N	I	I
A1	Provisions = satisfied	X			
A2	Provisions ≠ satisfied		X	X	
A3	DLT Chapter 18	X	X	X	X

Comment:

1) DLT 18.3(b) covers Sections 18.3.2, 18.3.2.1, and 18.3.2.2.

Section 18.4 Map



Section 18.4 Permissible Stresses in Concrete-Flexural Members

Datum 18.4(a)	Source	Label	Number
Compressive strength of concrete at time of initial prestress, psi.	X	FCI	
Extreme fiber stress in concrete in compression immediately after prestress transfer (before time-dependent prestress loss).	X	FCT	
If shown by analysis or test that performance will not be impaired.	X		

DLT 18.4(a)	Compression Strength Check - 1	1	2	3
C1	FCT $\leq$ 0.6 FCI?	Y	N	N
C2	Shown by analysis that performance will not be impaired?	I	Y	N
A1	Provisions = satisfied	X	X	
A2	Provisions $\neq$ satisfied			X
A3	DLT 18.4(b)	X	X	X

Comments: 1) DLT 18.4(a) covers Section 18.4.1(a) and 18.4.3.

2) Section 18.4 is somewhat ambiguous. In paragraph 18.4.1 and 18.4.2 it is stated that stresses shall not exceed the limits therein, but in paragraph 18.4.3 a provision is provided for cases where stress limits are exceeded. This type of ambiguity may be found elsewhere in the Code.

Datum 18.4(b)	Source	Label	Number
Extreme fiber stress in tension, other than at ends of simply supported members, immediately after prestress transfer.	X	FTT	
Extreme fiber stress in tension at ends of simply supported members immediately after prestress transfer.	X	FTTS	
If shown by analysis or test that performance will not be impaired by stresses which exceed permissible stresses.	X		
Square root of compressive strength of concrete at time of initial prestress, psi.	X	SRFCI	

DLT 18.4(b)	Tensile Strength Check - 1	1	2	3	4	5	
C1	FTT $\leq$ 3(SRFCI)?	Y	Y	Y	N	N	E L S E
C2	FTTS $\leq$ 6(SRFCI)?	Y	N	N	I	I	
C3	Shown by analysis or test that performance will not be impaired?		Y	N	Y	N	
A1	Provisions = satisfied	X	X		X		
A2	Provisions $\neq$ satisfied			X		X	
A3	DLT 18.4(c)		X	X	X	X	
A4	DLT 18.4(d)	X					
A5	Logical Error						X

Comment: 1) DLT 18.4(b) partially covers Section 18.4.1 and 18.4.3.

Datum 18.4(c)	Source	Label	Number
If bonded auxiliary reinforcement (nonprestressed or prestressed) provided in tensile zone to resist total tensile force in concrete.*	X		

DLT 18.4(c)	Auxiliary Tensile Reinforcement	1	2
C1	Bonded auxiliary reinforcement (nonprestressed or prestressed) provided in tensile zone to resist total tensile force in concrete?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT 18.4(d)	X	X

Comment:

1) DLT 18.4(c) partially covers Section 18.4.1.

* Total tensile force to be computed with the assumption of an uncracked section.

Datum 18.4(d)	Source	Label	Number
Specified compressive strength of concrete, psi.	X	FC	
Extreme fiber stress in compression at service loads after allowance for all prestress losses, psi.	X	FCS	
If shown by analysis or test that performance will not be impaired.	X		

DLT 18.4(d)	Stress Check at Service Loads	1	2	3
C1	FCS $\leq$ 0.45(FC)?	Y	N	N
C2	Shown by analysis or test that performance will not be impaired?	I	Y	N
A1	Provision = satisfied	X	X	
A2	Provision $\neq$ satisfied			X
A3	DLT 18.4(e)	X	X	X

Comment: 1) DLT 18.4(d) covers Section 18.4.2(a) and Section 18.4.3.

Datum 18.4(e)	Source	Label	Number
Square root of specified compressive strength of concrete, psi.	X	SRFC	
Extreme fiber stress at service loads in tension in precompressed tensile zone (after allowance for all pre-stress losses).	X	FTS	
If member is a two-way slab system	X		
If shown by analysis that performance will not be impaired.	X		

DLT 18.4(e)	Tensile Strength Check - 2	1	2	3	4	
C1	FTS $\leq$ 6(SRFC)?	Y	N	N	N	ELSE
C2	Member = two-way slab system?	I	Y	Y	N	
C3	Shown by analysis that performance will not be impaired?	I	Y	N		
A1	Provisions = satisfied	X	X			
A2	Provisions $\neq$ satisfied			X		
A3	DLT 18.4(f)				X	
A4	DLT Ch. 18	X	X	X		
A5	Logical Error					X

Comment: 1) DLT 18.4(e) partially covers Sections 18.4.2 and 18.4.3.

Datum 18.4(f)	Source	Label	Number
Square root of specified compressive strength of concrete, psi.	X	SRFC	
Extreme fiber stress in concrete in tension in precompressed tensile zone at service loads after allowance for all prestress losses, psi.	X	FTS	
If stress analysis based on transformed cracked sections and on bilinear moment-deflection relationships.	X		
If analysis shows that immediate and long-time deflections comply with requirements of Section 9.5.4 and where cover requirements comply with Section 7.7.3.2.	X		

DLT 18.4(f)	Tensile Strength Check - 3	1	2	3	4
C1	FTS $\leq$ 12(SRFC)?	Y	Y	Y	N
C2	Stress analysis based on transformed cracked sections and on bilinear moment-deflection relationships?	Y	Y	N	I
C3	Analysis shows that immediate and long-time deflections comply with requirements of Section 9.5.4 and where cover requirements comply with Section 7.7.3.2?	Y	N	I	I
A1	Provisions = satisfied	X			
A2	DLT 18.4(g)		X	X	X
A3	DLT Ch. 18	X			

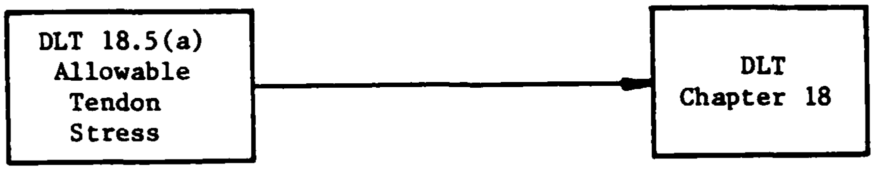
Comment: 1) DLT 18.4(f) partially covers Section 18.4.2.

Datum 18.4(g)	Source	Label	Number
If shown by test or analysis that performance will not be impaired by stresses which exceed permissible stresses.	X		

DLT 18.4(g) Tensile Strength Check - 4		1	2
C1	Shown by test or analysis that performance will not be impaired by stresses which exceed permissible stresses?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT Ch. 18	X	X

Comment: 1) DLT 18.4(g) covers Section 18.4.3.

Section 18.5 Map



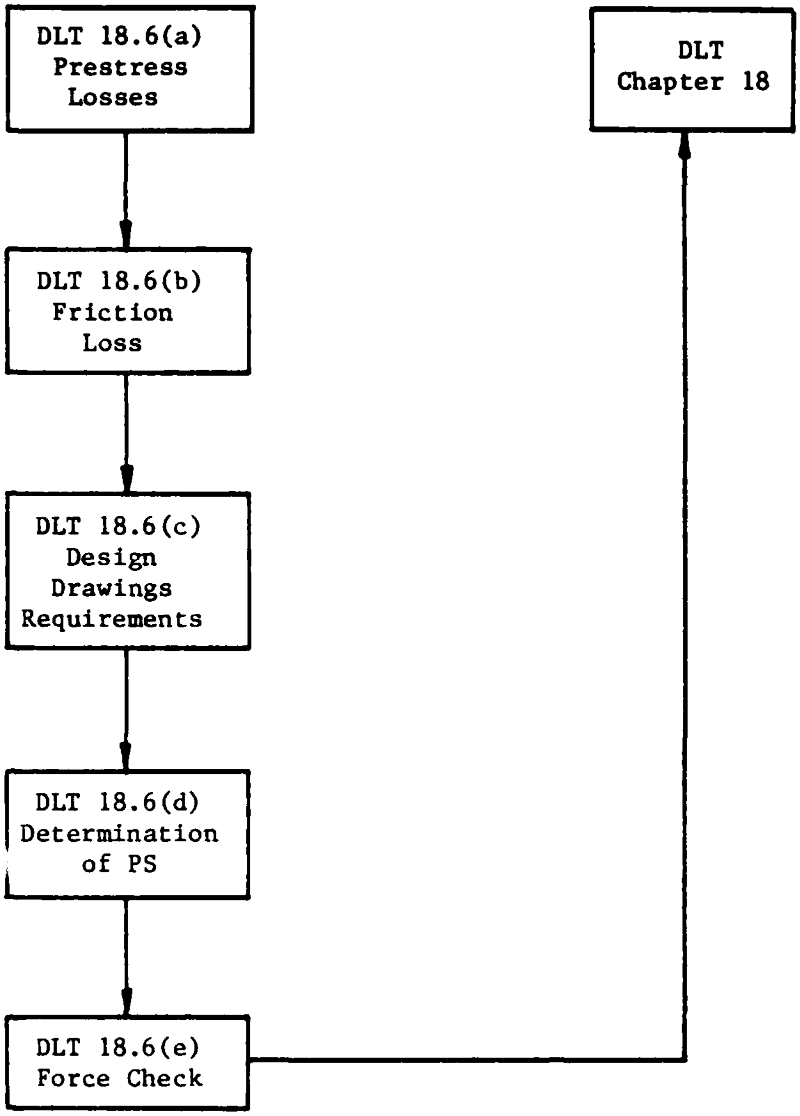
Section 18.5 Permissible Stresses in Prestressing Tendons

Datum 18.5(a)	Source	Label	Number
Specified tensile strength of prestressing tendons, psi.	X	FPU	
Specified yield strength of prestressing tendons, psi.	X	FPY	
Tensile stress in prestressing tendons due to tendon jacking force, psi.	X	FJF	
Maximum value recommended by manufacturer of the prestressing tendons or anchors, psi.	X	MRV	
Tensile stress in pretensioning tendons immediately after prestress transfer, psi.	X	FPT	
Tensile stress in post-tensioning tendons immediately after tendon anchorage, psi.	X	FTA	

DLT 18.5(a)	Allowable Tendon Stress	1	2	3	4
C1	FJF $\leq$ min[0.80 FPU, 0.94 FPY, MRV]?	Y	Y	Y	N
C2	FPT $\leq$ 0.70 FPU?	Y	Y	N	I
C3	FTA $\leq$ 0.70 FPU?	Y	N	I	I
A1	Provisions = satisfied	X			
A2	Provisions $\neq$ satisfied		X	X	X
A3	DLT Ch. 18	X	X	X	X

Comment: 1) DLT 18.5(a) covers Section 18.5.1.

Section 18.6 Map



Section 18.6 Loss of Prestress

Datum 18.6(a)	Source	Label	Number
If anchorage seating loss considered to determine effective prestress f_{se}.	X		
If elastic shortening of concrete considered to determine effective prestress f_{se}.	X		
If creep of concrete considered to determine effective prestress f_{se}.	X		
If shrinkage of concrete considered to determine effective prestress f_{se}.	X		
If relaxation of tendon stress considered to determine effective prestress f_{se}.	X		
If friction loss due to intended or unintended curvature in post-tensioning tendons considered to determine effective prestress.	X		

(Continued)

DLT 18.6(a) Prestress Losses		1	2	3	4	5	6	7
C1	Anchorage seating loss considered to determine effective prestress f_{se}?	Y	Y	Y	Y	Y	Y	N
C2	Elastic shortening of concrete considered to determine effective prestress f_{se}?	Y	Y	Y	Y	Y	N	I
C3	Creep of concrete considered to determine effective prestress f_{sc}?	Y	Y	Y	Y	N	I	I
C4	Shrinkage of concrete considered to determine effective prestress f_{se}?	Y	Y	Y	N	I	I	I
C5	Relaxation of tendon stress considered to determine effective prestress f_{se}?	Y	Y	N	I	I	I	I
C6	Friction loss due to intended or unintended curvature in post-tensioning tendons considered to determine effective prestress f_{se}?	Y	N	I	I	I	I	I
A1	Provisions = satisfied	X						
A2	Provisions ≠ satisfied		X	X	X	X	X	X
A3	DLT 18.6(b)	X	X	X	X	X	X	X

Comment: 1) DLT 18.6(a) covers Section 18.6.1.

Datum 18.6(b)	Source	Label	Number
If friction loss based on experimentally determined wobble, K, and curvature friction coefficients, μ.	X		
If values of K and μ verified during tendon stressing operations.	X		

DLT 18.6(b) Friction Loss		1	2	3
C1	Friction loss based on experimentally determined wobble, K, and curvature friction coefficients, μ?	Y	Y	N
C2	Values of K and μ verified during tendon stressing operations?	Y	N	I
A1	Provisions = satisfied	X		
A2	Provisions ≠ satisfied		X	X
A3	DLT 18.6(c)	X	X	X

Comment: 1) DLT 18.6(b) covers Section 18.6.2.2.

Datum 18.6(c)	Source	Label	Number
If values of wobble and curvature coefficients used in design shown on design drawings.	X		
If acceptable ranges of tendon jacking forces shown on design drawings.	X		
If tendon elongations shown on design drawings.	X		

DLT 18.6(c)	Design Drawings Requirements	1	2	3	4
C1	Values of wobble and curvature coefficients used in design shown on design drawings?	Y	Y	Y	N
C2	Acceptable ranges of tendon jacking forces shown on design drawings?	Y	Y	N	I
C3	Tendon elongations shown on design drawings?	Y	N	I	I
A1	Provisions = satisfied	X			
A2	Provisions ≠ satisfied		X	X	X
A3	DLT 18.6(d)	X	X	X	X

Comment: 1) DLT 18.6(c) covers Section 18.6.2.3.

Datum 18.6(d)	Source	Label	Number
Wobble friction coefficient per foot of prestressing tendon.	X	K	
Length of prestressing tendon element from jacking end to any point x.	X	ℓ	
Curvature friction coefficient.	X	μ	
Total angular change of prestressing tendon profile in radians from tendon jacking end to any point x.	X	α	
Prestressing tendon force at any point x.	X	PX	

DLT 18.6(d) Determination of PS		1	2
C1	$(K\ell + \mu\alpha) \leq 0.3$?	Y	N
A1	$PS = PX\ e^{(K\ell+\mu\alpha)}$		X
A2	$PS = PX(1 + K\ell + \mu\alpha)$	X	
A3	DLT 18.6(e)	X	X

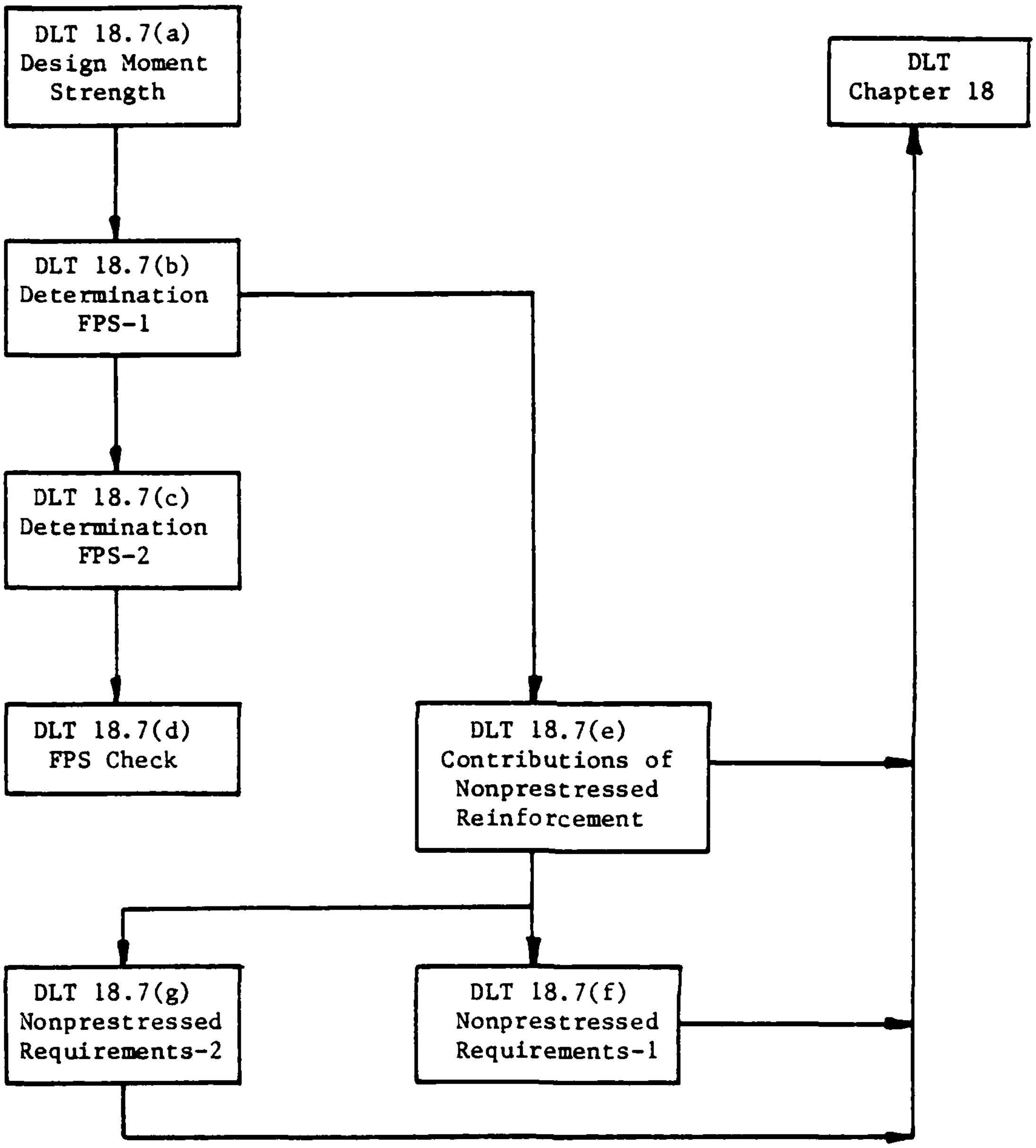
Comment: 1) DLT 18.6(d) partially covers Section 18.6.2.1.

Datum 18.6(e)	Source	Label	Number
Prestressing tendon force at jacking end used in design.	X	PSU	
Prestressing tendon force at jacking end.	DLT 18.6(d)	PS	

DLT 18.6(e) Force Check		1	2
C1	PSU = PS?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT Ch. 18	X	X

Comment: 1) DLT 18.6(e) covers Section 18.6.2.1.

Section 18.7 Map



Section 18.7 Flexural Strength

Datum 18.7(a)	Source	Label	Number
If design moment strength of flexural members computed by the strength design methods of the Code.	X		
If f_{ps} substituted for f_y in strength computations for prestressing tendons.	X		

DLT 18.7(a) Design Moment Strength		1	2	3
C1	Design moment strength of flexural members computed by the strength design methods of the Code?	Y	Y	N
C2	f_{ps} substituted for f_y in strength computations for prestressing tendons?	Y	N	I
A1	Provisions = satisfied	X		
A2	Provisions ≠ satisfied		X	X
A3	DLT 18.7(b)	X	X	X

Comment: 1) DLT 18.7(a) covers Section 18.7.1.

Datum 18.7(b)	Source	Label	Number
If f_{ps} determined based on strain compatibility.	X		
Effective stress in prestressed reinforcement (after allowance for all prestress losses), psi.	X	FSE	
Specified tensile strength of prestressing tendons, psi.	X	FPU	

DLT 18.7(b) Determination FPS - 1		1	2	3
C1	f_{ps} determined based on strain compatibility?	Y	N	N
C2	FSE $\geq$ 0.5 FPU?	I	Y	N
A1	DLT 18.7(e)	X		X
A2	DLT 18.7(c)		X	
A3	No Provision, DLT 18.7(e)			X

Comments:

1) DLT 18.7(b) is a switching DLT that partially covers Section 18.7.2.

2) As written, Section 18.7.2 seems to require Eqs (18-3) and (18-4) to be used if $f_{se} \geq 0.5 f_{pu}$. It is considered here to be optional.

Datum 18.7(c)	Source	Label	Number
If members with <u>bonded</u> prestressing tendons.	X		
Specified compressive strength of concrete, psi.	X	FC	
Specified tensile strength of prestressing tendons, psi.	X	FPU	
Raio of prestressed reinforcement A_{ps}/bd.	X	ROP	
Effective stress in prestressed reinforcement (after allowance for all prestress losses).	X	FSE	
Specified yield strength of prestressing tendons.	X	FPY	

DLT 18.7(c)	Determination FPS - 2	1	2
C1	Member with <u>bonded</u> prestressing tendons?	Y	N
A1	FPS = FPU(1 - 0.5 ROP FPU/FC)	X	
A2	FPS = min[(FSE + 10000 + FC/100 ROP), (FPY), (FSE + 60000)]		X
A3	DLT 18.7(d)	X	X

Comment: 1) DLT 18.7(c) partially covers Section 18.7.2.

Datum 18.7(d)	Source	Label	Number
Stress in prestressed reinforcement at nominal strength, psi.	DLT 18.7(c)	FPS	
Stress in prestressed reinforcement of nominal strength used in calculations, psi.	X	FPSU	

DLT 18.7(d) FPS Check		1	2
C1	FPS = FPSU?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT 18.7(e)	X	X

Comments: 1) DLT 18.7(d) partially covers Section 18.7.2.

2) No specific requirement exists to check the moment capacity of a prestressed flexural member.

Datum 18.7(e)	Source	Label	Number
If nonprestressed reinforcement used with prestressing tendons and considered to contribute to the tensile force and included in moment strength calculations.	X		
If nonprestressed reinforcement conforms to Section 3.5.3.	X		
If minimum length conforms to provisions of Chapter 12.	Ch. 12		

DLT 18.7(e) Nonprestressed Reinforcement		1	2	3	4	5	6
C1	Nonprestressed reinforcement used with prestressing tendons and considered to contribute to the tensile force and included in moment strength calculations?	Y	Y	Y	Y	N	N
C2	Nonprestressed reinforcement conforms to Section 3.5.3?	Y	Y	N	N	Y	N
C3	Minimum length conforms to provisions in Chapter 12?	Y	N	Y	N	I	I
A1	Provisions = satisfied	X		X			
A2	Provisions ≠ satisfied		X		X		
A3	DLT 18.7(f)	X	X				
A4	No Provision, DLT Ch. 18					X	X
A5	DLT 18.7(g)			X	X		

Comment: 1) DLT 18.7(e) covers Section 18.7.3 and a portion of 18.9.4.3.

Datum 18.7(f)	Source	Label	Number
If nonprestressed reinforcement conforms to Section 3.5.3.	X		
If tensile force of nonprestressed reinforcement included in moment strength computations.	X		
If stress in the nonprestressed reinforcement assumed equal to specified yield strength f_y.	X		

DLT 18.7(f)	Nonprestressed Requirements - 1	1	2
C1	Stress in the nonprestressed reinforcement assumed $\leq f_y$?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT Ch. 18	X	X

Comments: 1) DLT 18.7(f) partially covers Section 18.7.3.

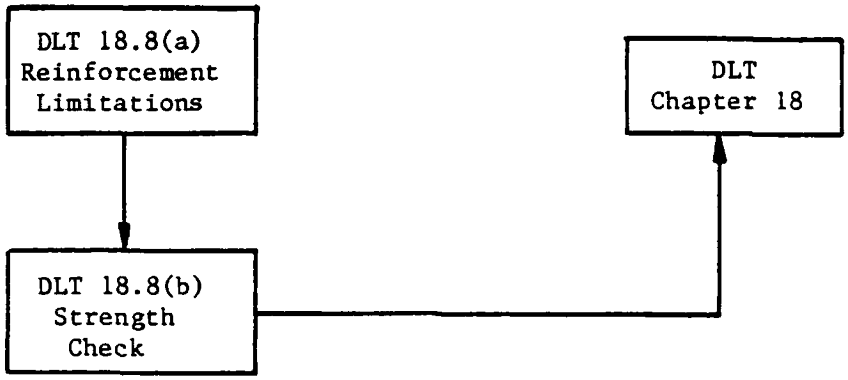
2) It is assumed here that stress assumed in nonprestressed reinforcement must not exceed f_y, but may be equal to or less.

Datum 18.7(g)	Source	Label	Number
Strain compatibility analysis made to determine stresses in nonprestressed reinforcement (other than that conforming to Section 3.5.3).	X		

DLT 18.7(g)	Nonprestressed Requirements - 2	1	2
C1	Strain compatibility analysis made to determine stresses in nonprestressed reinforcement?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT Ch. 18	X	X

Comment: 1) DLT 18.7(g) partially covers Section 18.7.3.

Section 18.8 Map



Section 18.8 Limits for Reinforcement of Flexural Members

Datum 18.8(a)	Source	Label	Number
pf_y/f'_c	X	ω	
$p'f_y/f'_c$	X	ω'	
$p_p f_{ps}/f'_c$	X	ω_p	
Reinforcement indices for flanged sections computed as for ω, ω_p, and ω' except that b shall be the web width, and reinforcement area shall be that required to develop compressive strength of web only.		$\omega_w, \omega_{pw}, \omega'_w$	
If design moment strength exceeds the moment strength based on the compression portion of the moment couple.	X		

DLT 18.8(a)	Reinforcement Limitations	1	2	3
C1	ω_p, $(\omega + \omega_p - \omega')$ and $(\omega_w + \omega_{pw} - \omega'_w) > 0.30$?	Y	Y	N
C2	Design moment strength exceeds the moment strength based on the compression portion of the moment couple?	Y	N	I
A1	Provision = satisfied		X	X
A2	Provision $\neq$ satisfied	X		
A3	DLT 18.8(b)	X	X	X

Comment: 1) DLT 18.8(a) covers Sections 18.8.1 and 18.8.2.

Datum 18.8(b)	Source	Label	Number
Factored load developed by total amount of prestressed and non-prestressed reinforcement.	X	PF	
Cracking load.	X	PCR	
If cracking load computed on basis of the modulus of rupture f_r specified in Section 9.5.2.3.	X		
Square root of specified compressive strength of concrete, psi.	X	$\sqrt{f'_c}$	

DLT 18.8(b)	Strength Check	1	2	3
C1	PF $\geq$ 1.2 PCR	Y	Y	N
C2	PCR computed on the basis of the modulus of rupture, $f_r = 7.5\sqrt{f'_c}$?	Y	N	I
A1	Provision = satisfied	X		
A2	Provision $\neq$ satisfied		X	X
A3	DLT Ch. 18	X	X	X

Comment: 1) DLT 18.8(b) covers Section 18.8.3.

Section 18.9 Minimum Bonded Reinforcement

Datum 18.9(a)	Source	Label	Number
If member is a flexural member with unbonded prestressing tendons.	X		
If member is a two-way flat plate defined as a solid slab of uniform thickness.	X		

DLT 18.9(a)	Type of Member	1	2	3
C1	Member is a flexural member with unbonded prestressing tendons?	Y	Y	N
C2	Member is a two-way flat plate defined as a solid slab of uniform thickness?	Y	N	I
A1	DLT 18.9(b)		X	
A2	DLT 18 9(c)	X		
A3	DLT Ch. 18			X

Comments: 1) DLT 18.9(a) is a switching DLT.

2) It is assumed that the Code requirements of Section 18.9.3 apply only to two-way flat plate of uniform thickness and that the minimum area of bonded reinforcement requirements of Section 18.9.2 apply to all other flexural members.

Datum 18.9(b)	Source	Label	Number
Area of bonded reinforcement provided.	X	ASP	
Area of that part of cross section between flexural tension face and center of gravity of gross section, sq in.	X	A	
If bonded reinforcement uniformly distributed over precomprssed tensile zone as close as practicable to extreme tension fiber.	X		
If bonded reinforcement provided regardless of service load stress conditions.	X		

DLT 18.9(b)	Minimum Reinforcement Area	1	2	3	4
C1	ASP $\geq$ 0.004 A?	Y	Y	Y	N
C2	Bonded reinforcement uniformly distributed over precompressed tensile zone as close as practicable to extreme tension fiber?	Y	Y	N	I
C3	Bonded reinforcement provided regardless of service load stress?	Y	N	I	I
A1	Provisions = satisfied	X			
A2	Provisions $\neq$ satisfied		X	X	X
A3	DLT 18.9(g)	X	X	X	X

Comment: 1) DLT 18.9(b) covers Sections 18.9.2, 18.9.2.1 and 18.9.2.2.

Datum 18.9(c)	Source	Label	Number
Computed tensile stress in concrete at service load (after allowance for all prestress losses) in <u>positive</u> moment area.	X	CTSC	
Square root of specified compressive strength of concrete, psi.	X	SRFC	
Tensile force in concrete due to unfactored dead load + live load.	X	NC	
Specified yield strength of nonpre-stressed reinforcement, psi.	X	FY	

DLT 18.9(c)	Two-Way Flat Plates - 1	1	2
C1	CTSC $\leq$ 2(SRFC)?	Y	N
A1	AS = 0	X	
A2	AS = NC/0.5 FY		X
A3	DLT 18.9(d)	X	X

Comments: 1) DLT 18.9(c) partially covers Sections 18.9.3.1 and 18.9.3.2.

2) It is assumed here that if computed tensile stress at service loads in concrete in positive moment area is less than 2(SRFC) no minimum bonded reinforcement is required.

Datum 18.9(d)	Source	Label	Number
Area of bonded reinforcement provided in positive moment area.	X	ASP	
Specified yield strength of nonprestressed reinforcement, psi.	X	FY	
If bonded reinforcement uniformly distributed over precompressed tensile zone as close as practicable to extreme tension fiber.	X		
Minimum area of bonded reinforcement.	DLT 18.9(c)	AS	

DLT 18.9(d) Two-Way Flat Plates - 2		1	2	3	4
C1	ASP $\geq$ AS?	Y	Y	Y	N
C2	FY $\leq$ 60000?	Y	Y	N	I
C3	Bonded reinforcement uniformly distributed over precompressed tensile zone as close as practicable to extreme tension fiber.	Y	N	I	I
A1	Provisions = satisfied	X			
A2	Provisions $\neq$ satisfied		X	X	X
A3	DLT 18.9(e)	X	X	X	X

Comment: 1) DLT 18.9(d) covers Section 18.9.3.2.

DLT 18.9(e)	Source	Label	Number
If the minimum length of bonded reinforcement is in accordance with the provisions of Chapter 12.	Ch. 12		

DLT 18.9(e) Minimum Length Check		1	2
C1	Minimum length of bonded reinforcement in accordance with provisions of Chapter 12?	Y	N
A1	Provisions = satisfied	X	
A2	Provisions ≠ satisfied		X
A3	DLT 18.9(f)	X	X

Comment: 1) DLT 18.9(e) partically covers Section 18.9.4.3.

Datum 18.9(f)	Source	Label	Number
Area of bonded reinforcement in each direction in negative moment areas at column supports.	X	ANMR	
Length of span in direction parallel that of the reinforcement being determined.	X	ℓ	
Overall thickness of member, in.	X	h	
If bonded reinforcement distributed within a slab width between lines that are 1.5 h outside opposite faces of the column support.	X		

DLT 18.9(f)	Two-Way Flat Plates - 3	1	2	3
C1	ANMR $\geq 0.00075\ell h$?	Y	Y	N
C2	Bonded reinforcement distributed within a slab width between lines that are 1.5 h outside opposite faces of the column support?	Y	N	I
A1	Provisions = satisfied	X		
A2	Provisions $\neq$ satisfied		X	X
A3	DLT 18.9(g)	X	X	X

Comment: 1) DLT 18.9(f) partially covers Section 18.9.3.3.

Datum 18.9(g)	Source	Label	Number
If at least 4 bars or wires provided in each direction.	X		
Spacing of the bonded reinforcement, in.	X	SBR	

DLT 18.9(g) Two-Way Flat Plates - 4		1	2	3
C1	At least 4 bars or wires provided in each direction?	Y	Y	N
C2	SBR $\leq$ 12 inches?	Y	N	I
A1	Provisions = satisfied	X		
A2	Provisions $\neq$ satisfied		X	X
A3	DLT 18.9(h)	X	X	X

Comment: 1) DLT 18.9(g) partially covers Section 18.9.3.3.

Datum 18.9(h)	Source	Label	Number
Length of bonded reinforcement in positive moment areas.	X	BRLP	
Clear span.	X	CL	
If reinforcement centered in positive moment area.	X		

DLT 18.9(h) Minimum Length - 1		1	2	3
C1	BRLP $\geq$ 1/3 CL?	Y	Y	N
C2	Reinforcement centered in positive moment area?	Y	N	I
A1	Provisions = satisfied	X		
A2	Provisions $\neq$ satisfied		X	X
A3	DLT 18.9(i)	X	X	X

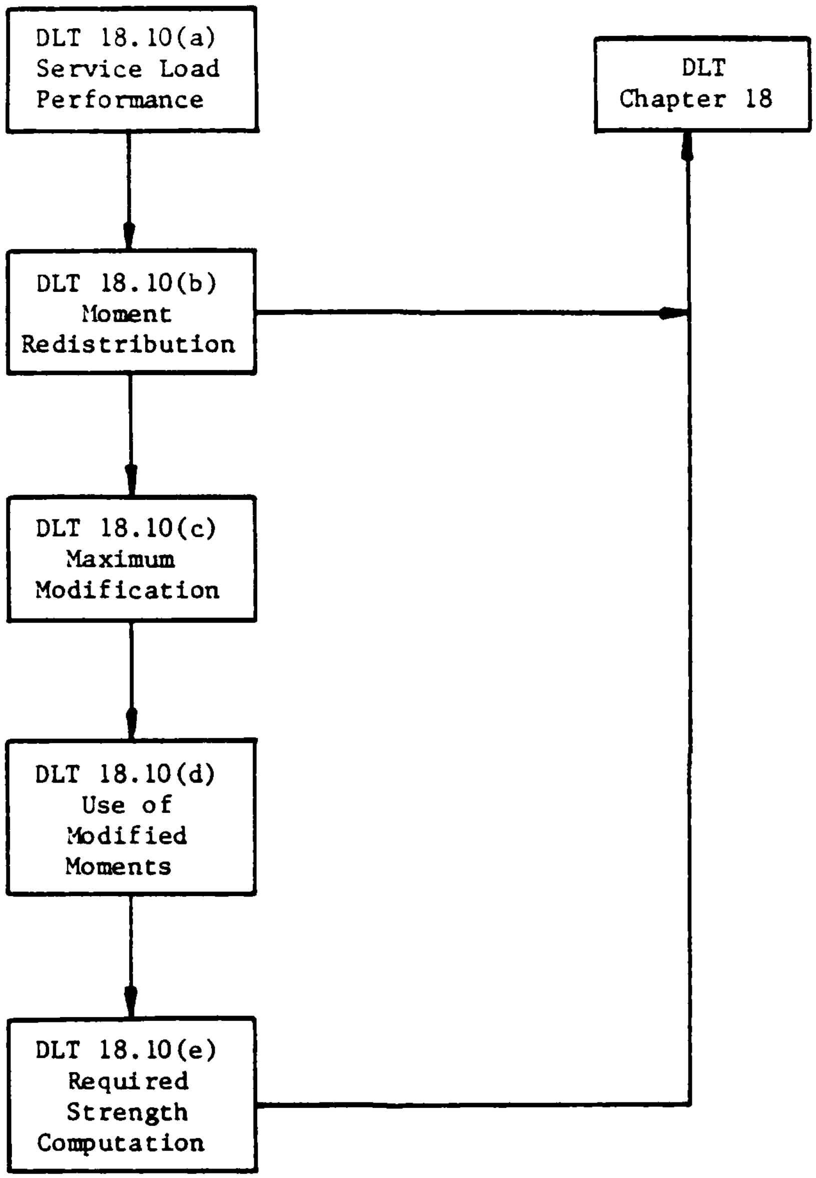
Comment: 1) DLT 18.9(h) covers Section 18.9.4.1.

Datum 18.9(i)	Source	Label	Number
Length of bonded reinforcement in negative moment area.	X	BRLN	
Clear span.	X	CL	
If bonded reinforcement placed on each side of support.	X		

DLT 18.9(i) Minimum Length - 2		1	2	3
C1	BRLN $\geq$ 1/6 CL?	Y	Y	N
C2	Bonded reinforcement placed on each side of support?	Y	N	I
A1	Provisions = satisfied	X		
A2	Provisions $\neq$ satisfied		X	X
A3	DLT Ch. 18	X	X	X

Comment: 1) DLT 18.9(i) covers Section 18.9.4.2.

Section 18.10 Map



Section 18.10 Statically Indeterminate Structures

Datum 18.10(a)	Source	Label	Number
If frames and continuous construction of prestressed concrete designed for satisfactory performance at service load conditions and for adequate strength.	X		
If performance at service load conditions determined by elastic analysis, considering reactions, moments, shears, and axial forces produced by prestressing, creep, shrinkage, temperature change, axial deformation, restraint of attached structural elements, and foundation settlement.	X		

DLT 18.10(a) Service Load Performance		1	2	3
C1	Frames and continuous construction of prestressed concrete designed for satisfactory performance at service load conditions and for adequate strength?	Y	Y	N
C2	Performance at service load conditions determined by elastic analysis, considering reactions, moments, shears, and axial forces produced by prestressing, creep, shrinkage, temperature change, axial deformation, restraint of attached structural elements, and foundation settlement?	Y	N	I
A1	Provisions = satisfied	X		
A2	Provisions ≠ satisfied		X	X
A3	DLT 18.10(b)	X	X	X

Comment: 1) DLT 18.10(a) covers Sections 18.10.1 and 18.10.2.

Datum 18.10(b)	Source	Label	Number
pf_y/f'_c	X	ω	
$p'f_y/f'_c$	X	ω'	
$p_p f_{ps}/f'_c$	X	ω_p	
Reinforcement indices for flanged sections computed as for ω, ω_p, and ω' except that b shall be the web width, and reinforcement area shall be that required to develop compressive strength of web only.	X	$\omega_w, \omega_{pw}, \omega'_w$	

DLT 18.10(b)	Moment Redistribution	1	2	3	4	5
C1	Negative moments redistributed?	Y	Y	Y	Y	N
C2	Flanged section?	Y	Y	N	N	I
C3	$\omega_p + (\omega - \omega_p - \omega') \leq 0.20$?			Y	N	I
C4	$(\omega_w + \omega_{pw} - \omega'_w) \leq 0.20$?	Y	N			I
A1	Provisions = satisfied	X		X		
A2	Provisions ≠ satisfied		X		X	
A3	DLT 18.10(c)	X	X	X	X	
A4	DLT 18.10(e)					X

Comment: 1) DLT 18.10(b) covers Section 18.10.4.3.

Datum 18.10(c)	Source	Label	Number
pf_y/f'_c	X	ω	
$p'f_y/f'_c$	X	ω'	
$p_p f_{ps}/f'_c$	X	ω_p	
Reinforcement indices for flanged sections computed as for ω, ω_p, and ω' except that b shall be the web width, and reinforcement area shall be that required to develop compressive strength of web only.	X	ω_w, ω_{pw}, ω_w'	
If bonded reinforcement provided at supports in accordance with Section 18.9.2.	X		
If negative moments calculated by elastic theory for any assumed loading arrangement.	X		
The amount (in percent) that the negative moments were increased or decreased by.	X	PM	

DLT 18.10(c)	Maximum Modification	1	2	3	4
C1	Bonded reinforcement provided at supports in accordance with Section 18.9.2?	Y	Y	Y	N
C2	Negative moments calculated by elastic theory for any assumed loading arrangement?	Y	Y	N	I
C3	$PM \leq 20\left(1 - \frac{\omega+\omega_p-\omega'}{0.3}\right)$ percent	Y	N	I	I
A1	Provisions = satisfied	X			
A2	Provisions ≠ satisfied		X	X	X
A3	DLT 18.10(d)	X	X	X	X

Comment: 1) DLT 18.10(c) covers Section 18.10.4.1.

Datum 18.10(d)	Source	Label	Number
If modified negative moments used for calculating moments at sections within spans for the same loading arrangement.	X		

DLT 18.10(d)	Use of Modified Moments	1	2
C1	Modified negative moments used for calculating moments at sections within spans for the same loading arrangement?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT 18.10(e)	X	X

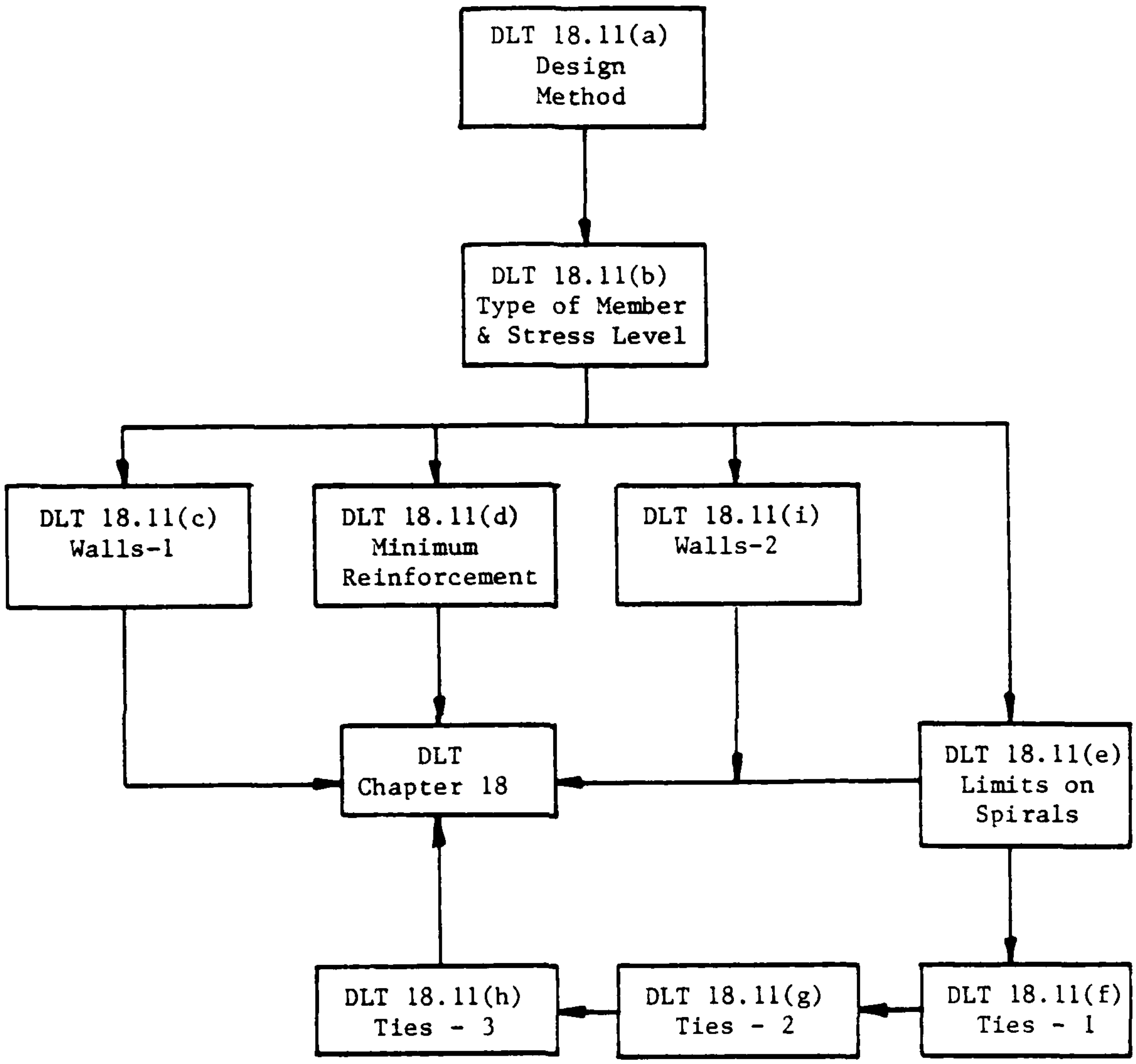
Comment: 1) DLT 18.10(d) covers Section 18.10.4.2.

Datum 18.10(e)	Source	Label	Number
If required strength computed as the sum of the moments due to reactions induced by prestressing (with a load factor of 1.0) and the moments due to factored loads including redistribution as permitted in Section 18.10.4.	X		

DLT 18.10(e)	Required Strength Computation	1	2
C1	Required strength computed as the sum of the moments due to reactions induced by prestressing (with a load factor of 1.0) and the moments due to factored loads including redistribution as permitted in Section 18.10.4?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT Ch. 18	X	X

Comment: 1) DLT 18.10(e) covers Section 18.10.3.

Section 18.11 Map



Section 18.11 Compression Members - Combined Flexure and Axial Loads

Datum 18.11(a)	Source	Label	Number
If prestressed concrete members subject to combined flexure and axial load, with or without nonprestressed reinforcement, proportioned by the strength design methods of the Code for members without prestressing.	X		
If effects of prestress, creep, shrinkage, and temperature change included.	X		

DLT 18.11(a) Design Methods		1	2	3
C1	Prestressed concrete members subject to combined flexure and axial load, with or without nonprestressed reinforcement, proportioned by the strength design methods of the Code for members without prestressing?	Y	Y	N
C2	Effects of prestress, creep, shrinkage, and temperature change included?	Y	N	I
A1	Provisions = satisfied	X		
A2	Provisions ≠ satisfied		X	X
A3	DLT 18.11(b)	X	X	X

Comment: 1) DLT 18.11(a) covers Section 18.11.1.

Datum 18.11(b)	Source	Label	Number
Average compressive stress in concrete due to effective prestress force only (after allowance for all prestress loss), psi.	X	FPC	
If member = wall.	X		
If member = column.	X		

DLT 18.11(b)	Member Type and Stress Level	1	2	3	4	
C1	FPC < 225?	Y	Y	N	N	ELSE
C2	Member = wall?	Y	N	Y	N	
C3	Member = column?	N	I	N	I	
A1	DLT 18.11(c)	X				
A2	DLT 18.11(d)		X			
A3	DLT 18.11(i)			X		
A4	DLT 18.11(e)				X	
A5	Logical Error					X

Comment: 1) DLT 18.11(b) is a switching DLT that partially covers Section 18.11.2.1, 18.11.2.2 and 18.11.2.3.

Datum 18.11(c)	Source	Label	Number
If minimum reinforcement in accordance with Section 10.15.	X		

DLT 18.11(c)	Minimum Reinforcement - Walls	1	2
C1	Minimum reinforcement in accordance with Section 10.15?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT Ch. 18	X	X

Comment: 1) DLT 18.11(c) partially covers Section 18.11.2.1.

Datum 18.11(d)	Source	Label	Number
If minimum reinforcement in accordance with Sections 7.10, 10.9.1 and 10.9.2.	X		

DLT 18.11(d) Minimum Reinforcement		1	2
C1	Minimum reinforcement in accordance with Sections 7.10, 10.9.1 and 10.9.2?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT Ch. 18	X	X

Comment: 1) DLT 18.11(d) partially covers Section 18.11.2.1.

Datum 18.11(e)	Source	Label	Number
If spirals used.	X		
If spirals conform to Section 7.10.4.	X		

DLT 18.11(e) Limits on Spirals		1	2	3
C1	Spirals used?	Y	Y	N
C2	Spirals conform to Section 7.10.4?	Y	N	I
A1	Provisions = satisfied	X		
A2	Provisions ≠ satisfied		X	
A3	DLT 18.11(f)			X
A4	DLT Ch. 18	X	X	

Comment: 1) DLT 18.11(e) covers Section 18.11.2.2(a).

Datum 18.11(f)	Source	Label	Number
If lateral ties used.	X		
If ties at least #3 in size or welded wire fabric of equivalent area.	X		
Vertical spacing of ties.	X		
Diameter of bar or wire.	X	DB	
Least dimension of compression member.	X	DLM	

DLT 18.11(f) Ties - I		1	2	3	4
C1	Lateral ties used?	Y	Y	Y	N
C2	Ties at least #3 in size or welded wire fabric of equivalent area?	Y	Y	N	I
C3	Vertical spacing of ties $\leq$ min[48 DB, DCM]?	Y	N	I	I
A1	Provision = satisfied	X			
A2	Provision $\neq$ satisfied		X	X	X
A3	DLT 18.11(g)	X	X	X	
A4	DLT Ch. 18				X

Comment: 1) DLT 18.11(f) covers Section 18.11.2.2 part (b).

Datum 18.11(g)	Source	Label	Number
If ties located vertically ≤ half a tie spacing above top of footing or slab in any story.	X		
If ties spaced ≤ half a tie spacing below lowest horizontal reinforcement in members supported above.	X		

DLT 18.11(g)		1	2	3
C1	Ties located vertically ≤ half a tie spacing above top of footing or slab in any story?	Y	Y	N
C2	Ties spaced ≤ half a tie spacing below lowest horizontal reinforcement in members supported above?	Y	N	I
A1	Provisions = satisfied	X		
A2	Provisions ≠ satisfied		X	X
A3	DLT 18.11(h)	X	X	X

Comment: 1) DLT 18.11(g) covers Section 18.11.2.2(c).

Datum 18.11(h)	Source	Label	Number
If beams or brackets frame into all sides of a column.	X		
If ties terminated ≤ 3 in. below lowest reinforcement in such beams or brackets.	X		

DLT 18.11(h) Ties - 3		1	2	3
C1	Beams or brackets frame into all sides of a column?	Y	Y	N
C2	Ties terminated ≤ 3 in. below lowest reinforcement in such beams or brackets?	Y	N	I
A1	Provisions = satisfied	X		
A2	Provisions ≠ satisfied		X	
A3	DLT Ch. 18	X	X	X

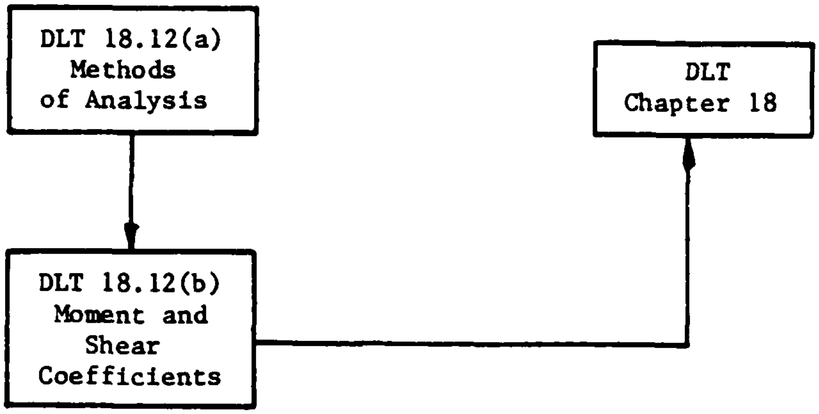
Comment: 1) DLT 18.11(h) covers Section 18.11.2.2(d).

Datum 18.11(i)	Source	Label	Number
If minimum reinforcement required by Section 10.15 is waived.	X		
If structural analysis shows adequate strength and stability.	X		

DLT 18.11(i) Walls - 2		1	2	3
C1	Minimum reinforcement required by Section 10.15 is waived?	Y	Y	N
C2	Structural analysis shows adequate strength and stability?	Y	N	I
A1	Provisions = satisfied	X		
A2	Provisions ≠ satisfied		X	
A3	DLT Ch. 18	X	X	X

Comment: 1) DLT 18.11(i) covers Section 18.11.2.3.

Section 18.12 Map



Section 18.12 Slab Systems

Datum 18.12(a)	Source	Label	Number
If prestressed slab systems reinforced in more than one direction.	X		
If designed by any procedure satisfying conditions of equilibrium and geometric compatibility.	X		
If column stiffnesses, rigidity of slab-column connections, and effects of prestressing in accordance with Section 18.10 considered in the analysis method.	X		

DLT 18.12(a)	Methods of Analysis	1	2	3	4
C1	Prestressed slab systems reinforced in more than one direction?	Y	Y	Y	N
C2	Designed by any procedure satisfying conditions of equilibrium and geometric compatibility?	Y	Y	N	I
C3	Column stiffnesses, rigidity of slab-column connections, and effects of prestressing in accordance with Section 18.10 considered in analysis method?	Y	N	I	I
A1	Provisions = satisfied	X			
A2	Provisions ≠ satisfied		X	X	X
A3	DLT 18.12(b)	X	X	X	X

Comment:

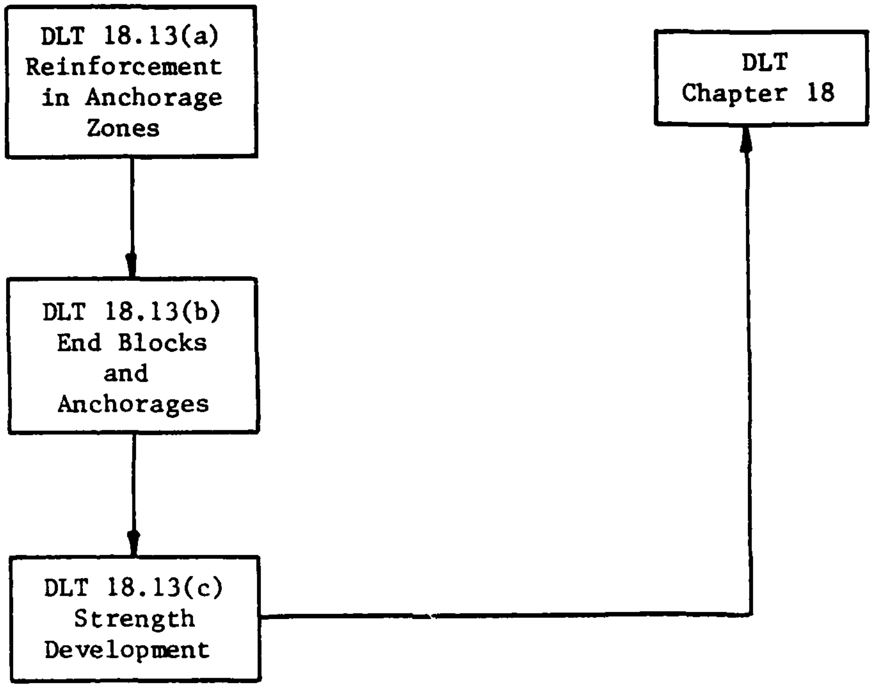
1) DLT 18.12(a) covers Section 18.12.1.

Datum 18.12(b)	Source	Label	Number
If moment and shear coefficients used for design of slab systems reinforced with nonprestressed reinforcement applied to prestressed slab systems.	X		

DLT 18.12(b)	Moment and Shear Coefficients	1	2
C1	Moment and shear coefficients used for design of slab systems reinforced with nonprestressed reinforcement applied to prestressed slab systems?	Y	N
A1	Provision = satisfied		X
A2	Provision ≠ satisfied	X	
A3	DLT Ch. 18	X	X

Comment: 1) DLT 18.12(b) covers Section 18.12.2.

Section 18.13 Map



Section 18.13 Tendon Anchorage Zones

Datum 18.13(a)	Source	Label	Number
If reinforcement provided where required in tendon anchorage zones to resist bursting, splitting, and spalling forces induced by tendon anchorages.	X		
If regions of abrupt change in section adequately reinforced.	X		

DLT 18.13(a)	Reinforcement in Anchorage Zones	1	2	3
C1	Reinforcement provided where required in tendon anchorage zones to resist bursting, splitting, and spalling forces induced by tendon anchorages?	Y	Y	N
C2	Regions of abrupt change in section adequately reinforced?	Y	N	I
A1	Provisions = satisfied	X		
A2	Provisions ≠ satisfied		X	X
A3	DLT 18.13(b)	X	X	X

Comment: 1) DLT 18.13(a) covers Section 18.13.1.

Datum 18.13(b)	Source	Label	Number
If end blocks provided where required for support bearing or for distribution of concentrated prestressing forces.	X		
If post-tensioning anchorages and supporting concrete designed to resist maximum jacking force for strength of concrete at time of prestressing.	X		

DLT 18.13(b) End Blocks and Anchorages		1	2	3
C1	End blocks provided where required for support bearing or for distribution of concentrated prestressing forces?	Y	Y	N
C2	Post-tensioning anchorages and supporting concrete designed to resist maximum jacking force for strength of concrete at time of prestressing?	Y	N	I
A1	Provisions = satisfied	X		
A2	Provisions ≠ satisfied		X	X
A3	DLT 18.13(c)	X	X	X

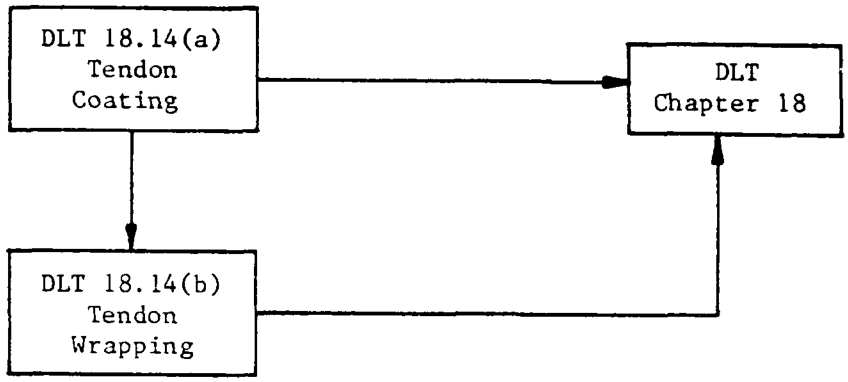
Comment: 1) DLT 18.13(b) covers Sections 18.13.2 and 18.13.3.

Datum 18.13(c)	Source	Label	Number
If post-tensioning anchorage zones designed to develop the guaranteed ultimate tensile strength of prestressing tendons using a strength reduction factor ϕ of 0.90 for concrete.	X		

DLT 18.13(c) Strength Development		1	2
C1	Post-tensioning anchorage zones designed to develop the guaranteed ultimate tensile strength of prestressing tendons using a strength reduction factor ϕ of 0.90 for concrete?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT Ch. 18	X	X

Comment: 1) DLT 18.13(c) covers Section 18.13.4.

Section 18.14 Map



Section 18.14 Corrosion Protection for Unbonded Prestressing Tendons

Datum 18.14(a)	Source	Label	Number
If member prestressed with unbonded tendons.	X		
If unbonded tendons completely coated with suitable material to ensure corrosion protection.	X		

DLT 18.14(a) Tendon Coating		1	2	3	
C1	Member prestressed with unbonded tendons?	Y	Y	N	ELSE
C2	Unbonded tendons completely coated with suitable material to ensure corrosion protection?	Y	N		
A1	Provisions = satisfied	X			
A2	Provisions ≠ satisfied		X		
A3	DLT 18.14(b)	X	X		
A4	DLT Ch. 18			X	
A5	Logical Error				X

Comment: 1) DLT 18.14(a) covers Section 18.14.1.

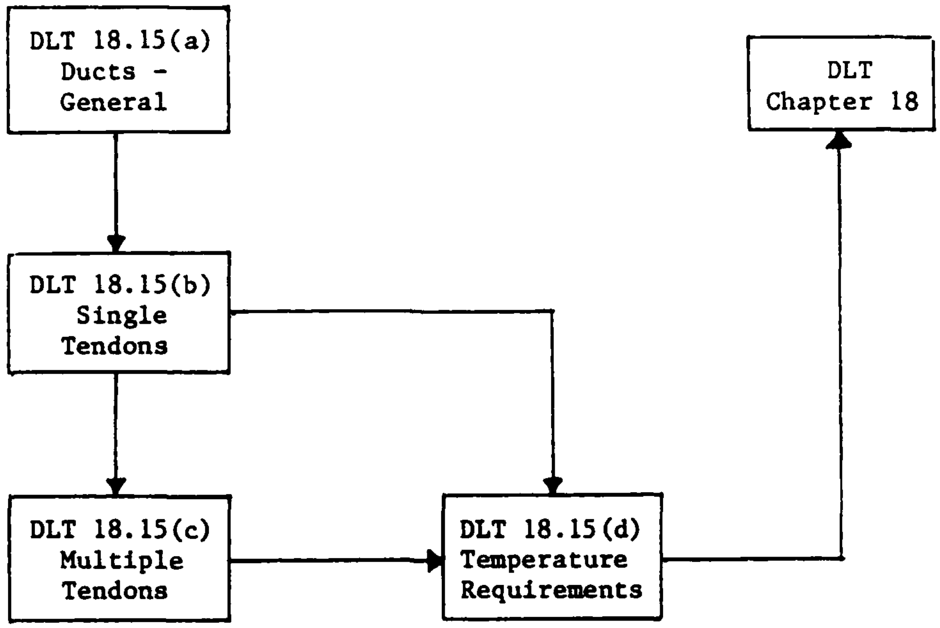
Datum 18.14(b)	Source	Label	Number
If unbonded tendon wrapped.	X		
If tendon wrapping continuous over entire length to be unbonded.	X		
If tendon wrapping prevents intrusion of cement paste or loss of coating materials during concrete placement.	X		

DLT 18.14(b) Tendon Wrapping		1	2	3	4
C1	Unbonded tendon wrapped?	Y	Y	Y	N
C2	Tendon wrapping continuous over entire length to be unbonded?	Y	Y	N	I
C3	Tendon wrapping prevents intrusion of cement paste or loss of coating materials during concrete placement?	Y	N	I	I
A1	Provisions = satisfied	X			
A2	Provisions ≠ satisfied		X	X	X
A3	DLT Ch. 18	X	X	X	X

Comments: 1) DLT 18.14(b) covers Section 18.14.2.

2) The language of the Code in Section 18.14.2 implies that the condition may exist where a tendon is only partially bonded. No provisions exist in the Code for this condition.

Section 18.15 Map



Section 18.15 Post-Tensioning Ducts

Datum 18.15(a)	Source	Label	Number
If ducts mortar-tight and non-reactive with concrete, tendons, or filler material.	X		
If ducts for grouted tendons.	X		
If ducts for unbonded tendons.	X		

DLT 18.15(a) Ducts General		1	2	3	4	
C1	Ducts mortar-tight and non-reactive with concrete, tendons, or filler material?	Y	Y	N	N	ELSE
C2	Ducts for grouted tendons?	Y	N	Y	N	
C3	Ducts for unbonded tendons?	N	Y	N	Y	
A1	Provisions = satisfied	X	X			
A2	Provisions ≠ satisfied			X	X	
A3	DLT 18.15(b)	X		X		
A4	DLT Ch. 18		X		X	
A5	Logical Error					X

Comments: 1) DLT 18.15(a) covers Section 18.15.1.

2) It is assumed that a condition of partial bonding does not exist.

Datum 18.15(b)	Source	Label	Number
If ducts grouted for single wire, strand, or bar tendon.	X		
Inside diameter of duct.	X	DID	
Tendon diameter.	X	TD	

DLT 18.15(b) Single Tendons		1	2	3
C1	Ducts grouted for Single wire, strand, or bar tendon?	Y	Y	N
C2	TD + 0.25 in. $\leq$ DID?	Y	N	I
A1	Provision = satisfied	X		
A2	Provision $\neq$ satisfied		X	
A3	DLT 18.15(c)			X
A4	DLT 18.15(d)	X	X	

Comment:

1) DLT 18.15(b) covers Section 18.15.2.

Datum 18.15(c)	Source	Label	Number
Inside cross sectional area of duct.	X	AID	
Area of tendons.	X	AT	

DLT 18.15(c)	Multiple Tendons	1	2
C1	AID $\geq$ 2(AT)?	Y	N
A1	Provision = satisfied	X	
A2	Provision $\neq$ satisfied		X
A3	DLT 18.15(d)	X	X

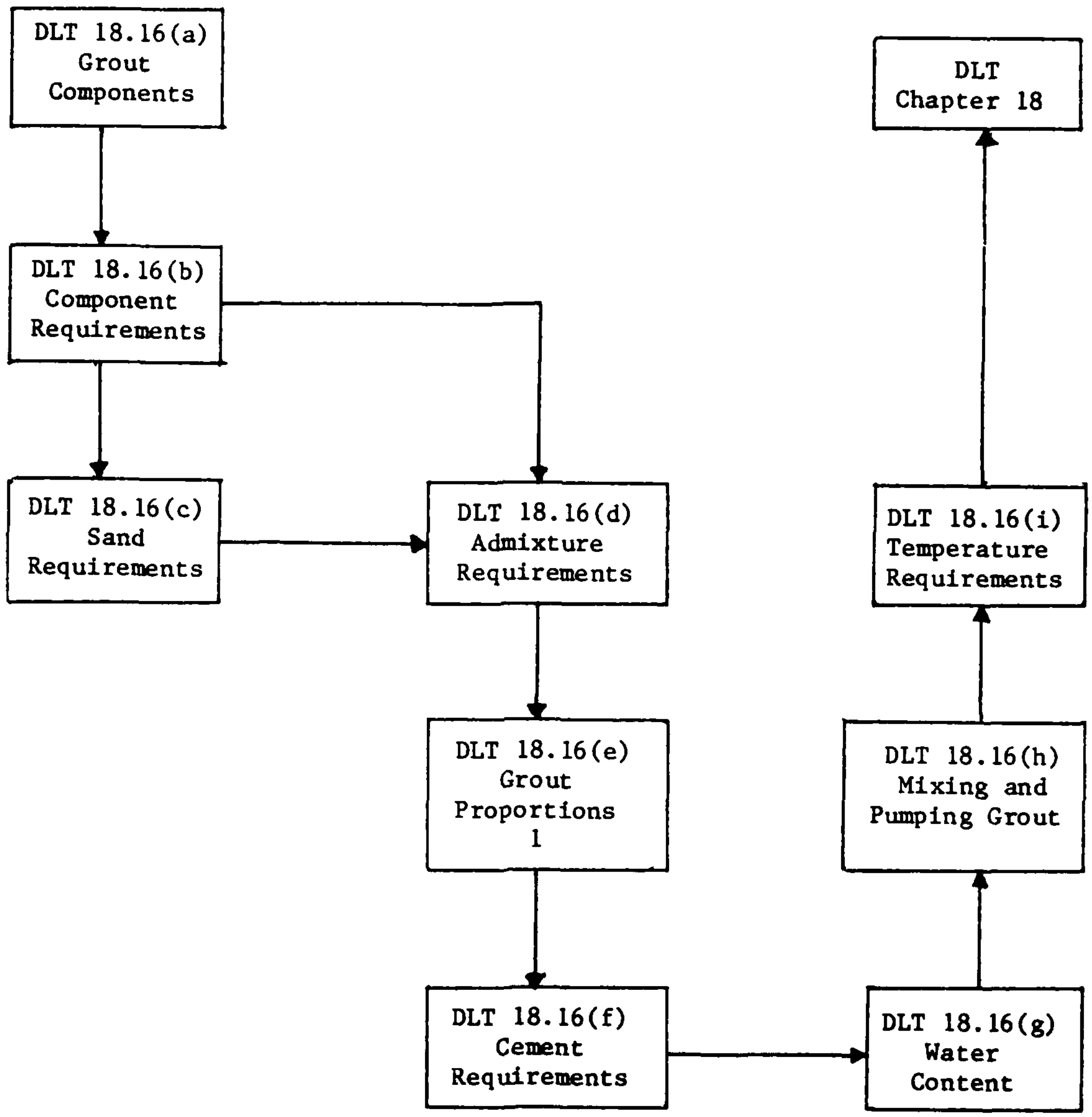
Comment: 1) DLT 18.15(c) covers Section 18.15.3.

Datum 18.15(d)	Source	Label	Number
If members to be grouted exposed to temperatures below freezing prior to grouting.	X		
If ducts maintained free of water.	X		

DLT 18.15(d)	Temperature Requirements	1	2	3
C1	Members to be grouted exposed to temperatures below freezing prior to grouting?	Y	Y	N
C2	Ducts maintained free of water?	Y	N	I
A1	Provisions = satisfied	X		
A2	Provisions ≠ satisfied		X	
A3	DLT Ch. 18	X	X	X

Comment: 1) DLT 18.15(d) covers Section 18.15.4.

Section 18.16 Map



Section 18.16 Grout for Bonded Prestressing Tendons

Datum 18.16(a)	Source	Label	Number
If grout consists of portland cement and water; or portland cement, sand, and water.	X		

DLT 18.16(a) Grout Components		1	2
C1	Grout consists of portland cement and water; or portland cement, sand, and water?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT 18.16(b)	X	X

Comments:

1) DLT 18.16(a) covers Section 18.16.1.

2) No provisions exist for admixtures in Section 18.16.1 although they may be used according to the provisions of Section 18.16.2(d).

Datum 18.16(b)	Source	Label	Number
If portland cement conforms to Section 3.2.	X		
If water conforms to Section 3.4.	X		
If sand used.	X		

DLT 18.16(b)	Component Requirements	1	2	3	4	5	6
C1	Portland cement conforms to Section 3.2?	Y	Y	Y	Y	N	N
C2	Water conforms to Section 3.4?	Y	Y	N	N	I	I
C3	Sand used?	Y	N	Y	N	Y	N
A1	Provisions = satisfied	X	X				
A2	Provisions ≠ satisfied			X	X	X	X
A3	DLT 18.16(c)	X		X		X	
A4	DLT 18.16(d)		X		X		X

Comment: 1) DLT 18.16(b) covers Section 18.16.2 parts (a) and (b).

Datum 18.16(c)	Source	Label	Number
If sand conforms to "Standard Specifications for Aggregate for Masonry Mortar" ASTM C144.	X		
If gradation modified as necessary to obtain satisfactory workability.	X		
If sand only violates gradation specifications of ASTM C144.	X		

DLT 18.16(c)	Sand Requirements	1	2	3	4	5	
C1	Sand conforms to "Standard Specifications for Aggregate for Masonry Mortar" ASTM C144?	Y	Y	N	N	N	E
							L
C2	Sand only violates gradation specifications of ASTM C144?	N	N	Y	Y	N	S
C3	Gradation modified as necessary to obtain satisfactory workability?	Y	N	Y	N	I	E
A1	Provisions = satisfied	X	X	X			
A2	Provisions ≠ satisfied				X	X	
A3	DLT 18.16(d)	X	X	X	X	X	
A4	Logical Error						X

Comment: 1) DLT 18.16(c) covers Section 18.16.2 part (c).

Datum 18.16(d)	Source	Label	Number
If admixtures used.	X		
If admixtures conform to Section 3.6 and known to have no injurious effects on grout, steel, or concrete.	X		
If calcium chloride used.	X		

DLT 18.16(d) Admixture Requirements		1	2	3	4
C1	Admixtures used?	Y	Y	Y	N
C2	Admixtures conform to Section 3.6 and known to have no injurious effects on grout, steel, or concrete?	Y	Y	N	I
C3	Calcium chloride used?	Y	N	I	I
A1	Provisions = satisfied		X		
A2	Provisions ≠ satisfied	X		X	
A3	DLT 18.16(e)	X	X	X	X

Comment:

1) DLT 18.16(d) cover Section 18.16.2 part (d).

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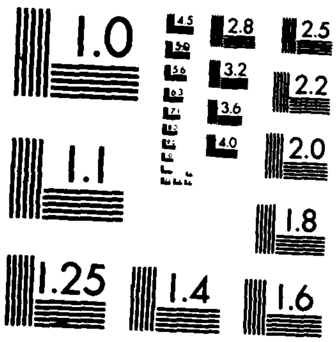

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Datum 18.16(e)	Source	Label	Number
If proportions of materials for grout based on results of tests on fresh and hardened grout prior to beginning grouting operations.	X		
If proportions of materials for grout based on prior documented experience with similar materials and equipment and under comparable field conditions.	X		

DLT 18.16(e) Grout Proportions - 1		1	2	3
C1	Proportions of materials for grout based on results of tests on fresh and hardened grout prior to beginning grouting operations?	Y	N	N
C2	Proportions of materials for grout based on prior documented experience with similar materials and equipment and under comparable field conditions?	I	Y	N
A1	Provisions = satisfied	X	X	
A2	Provisions ≠ satisfied			X
A3	DLT 18.16(f)	X	X	X

Comment: 1) DLT 18.16(e) covers Section 18.16.3.1.

Datum 18.16(f)	Source	Label	Number
If cement used in the work corresponds to that on which selection of grout proportions was based.	X		

DLT 18.16(f) Cement Requirements		1	2
C1	Comment used in the work corresponds to that on which selection of grout proportions was based?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT 18.16(g)	X	X

Comment: 1) DLT 18.16(f) covers Section 18.16.3.2.

Datum 18.16(g)	Source	Label	Number
If water content the minimum necessary for pumping of grout.	X		
Water-cement ratio by weight.	X	WCR	
If water added to increase grout flowability that has been decreased by delayed use of grout.	X		

DLT 18.16(g) Water Content		1	2	3	4
C1	Water content the minimum necessary for pumping of grout?	Y	Y	Y	N
C2	WCR $\leq$ 0.45?	Y	Y	N	I
C3	Water added to increase grout flowability that has been decreased by delayed use of grout?	Y	N	I	I
A1	Provisions = satisfied		X		
A2	Provisions $\neq$ satisfied	X		X	X
A3	DLT 18.16(h)	X	X	X	X

Comment: 1) DLT 18.16(g) covers Sections 18.16.3.3 and 18.16.3.4.

Datum 18.16(h)	Source	Label	Number
If grout mixed in equipment capable of continuous mechanical mixing and agitation that will produce uniform distribution of materials.	X		
If grout passed through screens and pumped in a manner that will completely fill tendon ducts.	X		

DLT 18.16(h) Mixing and Pumping Grout		1	2	3
C1	Grout mixed in equipment capable of continuous mechanical mixing and agitation that will produce uniform distribution of materials?	Y	Y	N
C2	Grout passed through screens and pumped in a manner that will completely fill tendon ducts?	Y	N	I
A1	Provisions = satisfied	X		
A2	Provisions ≠ satisfied		X	X
A3	DLT 18.16(i)	X	X	X

Comment: 1) DLT 18.16(h) covers Section 18.16.4.1.

Datum 18.16(i)	Source	Label	Number
Temperature of member at time of grouting.	X	TG	
If member maintained above 35°F until field cured 2 in. cubes of grout reach a minimum compressive strength of 800 psi.	X		
Grout temperatures during mixing and pumping.	X	GTMP	

DLT 18.16(i)	Temperature Requirements	1	2	3	4
C1	TG > 35°F?	Y	Y	Y	N
C2	Member maintained above 35°F until field cured 2 in. cubes of grout reach a minimum compressive strength of 800 psi?	Y	Y	N	I
C3	GTMP $\leq$ 90°F?	Y	N	I	I
A1	Provisions = satisfied	X			
A2	Provisions $\neq$ satisfied		X	X	X
A3	DLT Ch. 18	X	X	X	X

Comment: 1) DLT 18.16(i) covers Sections 18.16.4.2 and 18.16.4.3.

Section 18.17 Map

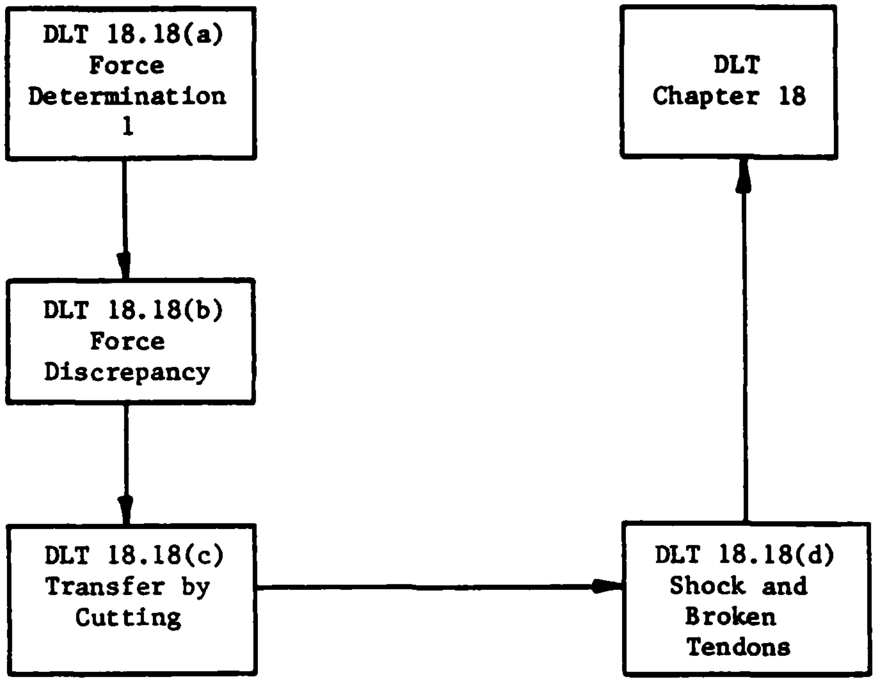
Section 18.17 Protection for Prestressing Tendons

Datum 18.17(a)	Source	Label	Number
If burning or welding operations in vicinity of prestressing tendons carefully performed so that tendons are not subject to excessive temperatures, welding sparks, or ground currents.	X		

DLT 18.17(a) Tendon Protection		1	2
C1	Burning or welding operations in vicinity of prestressing tendons carefully performed so that tendons are not subject to excessive temperatures welding sparks, or ground currents?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT Ch. 18	X	X

Comment: 1) DLT 18.17(a) covers Section 18.17.

Section 18.18 Map



Section 18.18 Application and Measurement of Prestressing Force

Datum 18.18(a)	Source	Label	Number
If prestressing force determined by measurement of tendon elongation.	X		
If required elongation determined from average load-elongation curves for prestressing tendons used.	X		
If prestressing force determined by observation of jacking force on a calibrated gage or load cell or by use of a calibrated dynamometer.	X		

DLT 18.18(a)	Force Determination	1	2	3	4	5	6	
C1	Prestressing force determined by measurement of tendon elongation?	Y	Y	Y	Y	N	N	E L
C2	Required elongation determined from average load-elongation curves for prestressing tendons used?	Y	N	Y	N			S E
C3	Prestressing force determined by observation of jacking force on a calibrated gage or load cell or by use of a calibrated dynamometer?	Y	Y	N	N	Y	N	
A1	Provisions = satisfied	X						
A2	Provisions ≠ satisfied		X	X	X	X	X	
A3	DLT 18.18(b)	X	X					
A4	DLT 18.18(c)			X	X	X	X	
A4	Logical Error							X

Comment: 1) DLT 18.18(a) covers partially Section 18.18.1.

Datum 18.18(b)	Source	Label	Number
If cause of any difference in force determination between measurement of elongation and jacking force that exceeds 5% ascertained and corrected.	X		

DLT 18.18(b) Force Discrepancy		1	2
C1	Cause of any difference in force determination between measurement of elongation and jacking force that exceeds 5% ascertained and corrected?	Y	N
A1	Provision = satisfied	X	
A2	Provision ≠ satisfied		X
A3	DLT 18.18(c)	X	X

Comment: 1) DLT 18.18(b) partially covers Section 18.18.1.

Datum 18.18(c)	Source	Label	Number
If transfer of force from bulkheads of pretensioning bed to concrete accoumpclished by flame cutting pre-stressing tendons.	X		
If cutting points and cutting sequence predetermined to avoid undesired temporary stresses.	X		

DLT 18.18(c)	Transfer by Cutting	1	2	3
C1	Transfer of force from bulkheads of pretensioning bed to concrete accomplished by flame cutting prestressing tendons?	Y	Y	N
C2	Cutting points and cutting sequence predetermined to avoid undesired temporary stresses?	Y	N	I
A1	Provision = satisfied	X		
A2	Provision ≠ satisfied		X	
A3	DLT 18.18(d)	X	X	X

Comment:

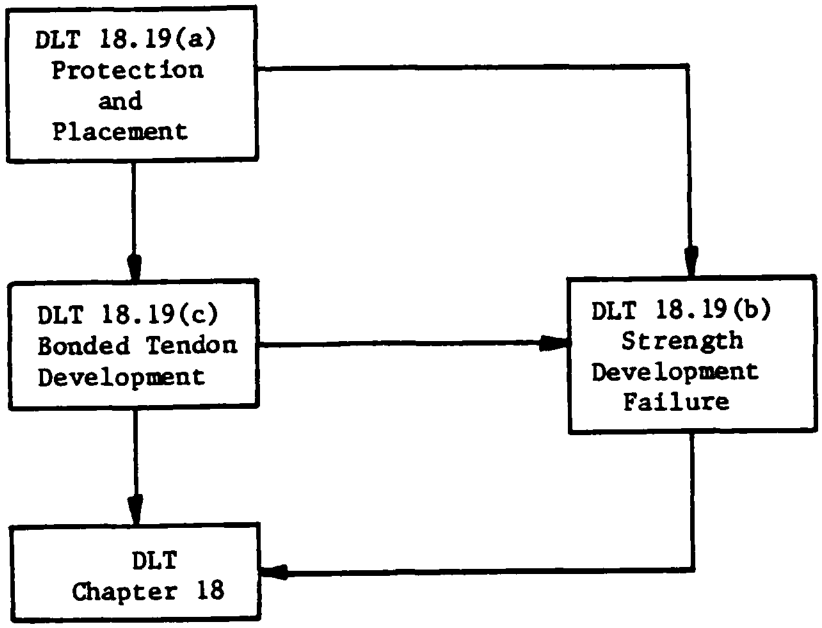
1) DLT 18.18(c) covers Section 18.18.2.

Datum 18.18(d)	Source	Label	Number
If long lengths of exposed pretensioned strand cut near the member to minimize shock to concrete.	X		
Total loss of prestress due to unre-placed broken tendons.	X	TLBT	
Total prestress.	X	TP	

DLT 18.18(d) Shock and Broken Tendons		1	2	3
C1	Long lengths of exposed pretensioned strand cut near the member to minimize shock to concrete?	Y	Y	N
C2	TLBT $\leq$ 0.02 TP?	Y	N	I
A1	Provision = satisfied	X		
A2	Provision $\neq$ satisfied		X	X
A3	DLT Ch. 18	X	X	X

Comment: 1) DLT 18.18(d) covers Sections 18.18.3 and 18.18.4.

Section 18.19 Map



Section 18.19 Post-Tensioning Anchorage and Couplers

Datum 18.19(a)	Source	Label	Number
If anchorage and fittings permanently protected against corrosion.	X		
If couplers placed in areas approved by the Engineer and enclosed in housing long enough to permit necessary movements.	X		
If unbonded construction used.	X		

DLT 18.19(a)	Protection and Placement	1	2	3	4	5	6
C1	Anchorage and end fittings permanently protected against corrosion?	Y	Y	Y	Y	N	N
C2	Couplers placed in areas approved by the Engineer and enclosed in housing long enough to permit necessary movements?	Y	Y	N	N	I	I
C3	Unbonded construction used?	Y	N	Y	N	Y	N
A1	Provisions = satisfied	X	X				
A2	Provisions ≠ satisfied			X	X	X	X
A3	DLT 18.19(b)	X		X		X	
A4	DLT 18.19(c)		X		X		X

Comment:

1) DLT 18.19(a) covers Sections 18.19.3 and 18.19.5.

Datum 18.19(b)	Source	Label	Number
If anchorages and couplers develop the specified ultimate strength of the tendons without exceeding anticipated set.	X		
If member subject to repetitive loads.	X		
If special attention given to the possibility of fatigue in anchorages and couplers.	X		

DLT 18.19(b) Strength Development and Fatigue		1	2	3	4
C1	Anchorages and couplers develop the specified ultimate strength of the tendons without exceeding anticipated set?	Y	Y	Y	N
C2	Member subject to repetitive loads?	Y	Y	N	I
C3	Special attention given to the possibility of fatigue in anchorages and couplers?	Y	N	I	I
A1	Provisions = satisfied	X		X	
A2	Provisions ≠ satisfied		X		X
A3	DLT Ch. 18	X	X	X	X

Comment: 1) DLT 18.19(b) covers Sections 18.19.1 and 18.19.4.

Datum 18.19(c)	Source	Label	Number
If anchorages develop at least 90% of the specified ultimate strength of the tendons when tested in an unbonded condition without exceeding anticipated set.	X		
If anchorages develop 100% of specified ultimate strength of the tendons after tendons are bonded in member.	X		

DLT 18.19(c)	Bonded Tendon Development	1	2	3
C1	Anchorages develop at least 90% of the specified ultimate strength of the tendons when tested in an unbonded condition without exceeding anticipated set?	Y	Y	N
C2	Anchorages develop 100% of specified ultimate strength of the tendons after tendons are bonded in member?	Y	N	I
A1	Provisions = satisfied	X		
A2	Provisions ≠ satisfied		X	X
A3	DLT Ch. 18	X	X	X

Comment: 1) DLT 18.19(c) covers Section 18.19.2.

WATERWAYS EXPERIMENT STATION REPORTS PUBLISHED UNDER THE COMPUTER-AIDED STRUCTURAL ENGINEERING (CASE) PROJECT

	Title	Date
Technical Report K-78-1	List of Computer Programs for Computer-Aided Structural Engineering	Feb 1978
Instruction Report O-79-2	User's Guide Computer Program with Interactive Graphics for Analysis of Plane Frame Structures (CFRAME)	Mar 1979
Technical Report K-80-1	Survey of Bridge-Oriented Design Software	Jan 1980
Technical Report K-80-2	Evaluation of Computer Programs for the Design/Analysis of Highway and Railway Bridges	Jan 1980
Instruction Report K-80-1	User's Guide Computer Program for Design/Review of Curvilinear Conduits/Culverts (CURCON)	Feb 1980
Instruction Report K-80-3	A Three-Dimensional Finite Element Data Edit Program	Mar 1980
Instruction Report K-80-4	A Three-Dimensional Stability Analysis/Design Program (3DSAD)	
	Report 1 General Geometry Module	Jun 1980
	Report 3 General Analysis Module (CGAM)	Jun 1982
	Report 4 Special-Purpose Modules for Dams (CDAMS)	Aug 1983
Instruction Report K-80-6	Basic User's Guide: Computer Program for Design and Analysis of Inverted-T Retaining Walls and Floodwalls (TWDA)	Dec 1980
Instruction Report K-80-7	User's Reference Manual Computer Program for Design and Analysis of Inverted-T Retaining Walls and Floodwalls (TWDA)	Dec 1980
Technical Report K-80-4	Documentation of Finite Element Analyses	
	Report 1: Longview Outlet Works Conduit	Dec 1980
	Report 2: Anchored Wall Monolith, Bay Springs Lock	Dec 1980
Technical Report K-80-5	Basic Pile Group Behavior	Dec 1980
Instruction Report K-81-2	User's Guide: Computer Program for Design and Analysis of Sheet Pile Walls by Classical Methods (CSHTWAL)	
	Report 1. Computational Processes	Feb 1981
	Report 2. Interactive Graphics Options	Mar 1981
Instruction Report K-81-3	Validation Report Computer Program for Design and Analysis of Inverted-T Retaining Walls and Floodwalls (TWDA)	Feb 1981
Instruction Report K-81-4	User's Guide Computer Program for Design and Analysis of Cast-in-Place Tunnel Linings (NEWTUN)	Mar 1981
Instruction Report K-81-6	User's Guide Computer Program for Optimum Nonlinear Dynamic Design of Reinforced Concrete Slabs Under Blast Loading (CBARCS)	Mar 1981
Instruction Report K-81-7	User's Guide Computer Program for Design or Investigation of Orthogonal Culverts (CORTCUL)	Mar 1981
Instruction Report K-81-9	User's Guide Computer Program for Three-Dimensional Analysis of Building Systems (CTABS80)	Aug 1981
Technical Report K-81-2	Theoretical Basis for CTABS80 A Computer Program for Three-Dimensional Analysis of Building Systems	Sep 1981
Instruction Report K-82-6	User's Guide Computer Program for Analysis of Beam-Column Structures with Nonlinear Supports (CBEAMC)	Jun 1982
Instruction Report K-82-7	User's Guide Computer Program for Bearing Capacity Analysis of Shallow Foundations (CBEAR)	Jun 1982

(Continued)

WATERWAYS EXPERIMENT STATION REPORTS PUBLISHED UNDER THE COMPUTER-AIDED STRUCTURAL ENGINEERING (CASE) PROJECT

(Concluded)

	Title	Date
Instruction Report K-83-1	User's Guide: Computer Program With Interactive Graphics for Analysis of Plane Frame Structures (CFRAME)	Jan 1983
Instruction Report K-83-2	User's Guide: Computer Program for Generation of Engineering Geometry (SKETCH)	Jun 1983
Instruction Report K-83-5	User's Guide: Computer Program to Calculate Shear, Moment, and Thrust (CSMT) from Stress Results of a Two-Dimensional Finite Element Analysis	Jul 1983
Technical Report K-83-1	Basic Pile Group Behavior	Sep 1983
Technical Report K-83-3	Reference Manual: Computer Graphics Program for Generation of Engineering Geometry (SKETCH)	Sep 1983
Technical Report K-83-4	Case Study of Six Major General-Purpose Finite Element Programs	Oct 1983
Instruction Report K-84-2	User's Guide: Computer Program for Optimum Dynamic Design of Nonlinear Metal Plates Under Blast Loading (CSDOOR)	Jan 1984
Instruction Report K-84-7	User's Guide: Computer Program for Determining Induced Stresses and Consolidation Settlements (CSETT)	Aug 1984
Instruction Report K-84-8	Seepage Analysis of Confined Flow Problems by the Method of Fragments (CFRAG)	Sep 1984
Instruction Report K-84-11	User's Guide for Computer Program CGFAG, Concrete General Flexure Analysis with Graphics	Sep 1984
Technical Report K-84-3	Computer-Aided Drafting and Design for Corps Structural Engineers	Oct 1984
Technical Report ATC-86-5	Decision Logic Table Formulation of ACI 318-77, Building Code Requirements for Reinforced Concrete for Automated Constraint Processing, Volumes I and II	Jun 1986

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